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The Engineer

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PUBLIC NOTICES

WORKS MANAGER FOR THE NORTH-WESTERN RAILWAY CARRIAGE AND WAGON WORKSHOPS IN INDIA.

The Secretary of State for India invites APPLICATIONS for an APPOINTMENT as WORKS MANAGER for the Carriage and Wagon Shops of the North-Western Railway at Lahore, on a five years' agreement in the first instance, on a salary of Rs. 1000 a month, rising by annual increments of Rs. 50 a month to Rs. 1200 a month.

Candidates should be about 36 to 40 years of age. They should have been regularly trained as Mechanical Engineers and have had subsequent experience in Carriage and Wagon Work either in a railway workshop or with a well-known firm of carriage and wagon builders. They must be well versed in the construction and maintenance of modern railway rolling stock and possess a good knowledge of modern methods of workshop management. They should have had experience in the production of duplicate parts for the repair and maintenance of rolling stock, especially high-capacity (all steel) wagons, and should be well acquainted with the latest methods of mass production of carriage and wagon details from modern manufacturing plant and high-class automatic machinery. They should also be acquainted with piecework and bonus systems of working.

They must be good organisers, strict disciplinarians, able to control labour, and should have held positions of responsibility in either a railway carriage and wagon workshop or with a contract firm of carriage and wagon builders.

Full particulars regarding the terms and conditions of appointment can be obtained from the SECRETARY, Public Works Department, India Office, Whitehall, S.W. 1, and applications for the appointment, giving full particulars of the candidate's age, education, training and experience, should reach him not later than the 15th July next.

India Office,
6th June, 1922. 8488

Draughtsman (Carriage and Wagon) REQUIRED for the TANGANYIKA GOVERNMENT RAILWAY for one tour of 20 to 30 months, with possible permanency. Salary £300-£15-£400, payable in the Territory in local currency, plus a temporary local allowance of 25 per cent. up to 31st March, 1923, when the arrangement will be subject to review. Outfit allowance of £30 on first appointment. Free quarters and passages. Liberal leave in England on full salary. Candidates, age 23 to 40, must be thoroughly experienced in carriage and wagon work.—Apply at once, by letter, stating age, whether married or single, and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/11,515. 8755

The Nigerian Government has FOR DISPOSAL FIVE PETERS SINGLE-CHAIN GRABS, plain bucket type without tines, 1 cubic yard capacity, complete with suspender and ball swivel. Practically new.—Offers to be addressed to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster. 8718

G. R.

BY DIRECTION OF THE DISPOSAL BOARD.
SOUTHAMPTON.
THE VALUABLE
FREEHOLD ROLLING MILLS,
KNOWN AS
GOVERNMENT ROLLING MILLS, SOUTHAMPTON,
including certain PLANT.

To be Sold
(by Private Treaty).

SITUATION.—The property is situated in Weston Grove, close to the railway, tram and ferry, and adjacent to the River Itchen, in which is situate a jetty connected with the factory.

AREA OF LAND.—About 82 acres.

BUILDINGS.—The main buildings are of substantial brick construction with Belfast truss roofs, and the property is equipped with the most modern mills and auxiliary plant and machinery.

The principal buildings comprise :—

	Approx. floor area, feet super.
Rolling mills	124,200
Capping shop	74,800
Foundry	74,800
Warehouse No. 1	19,900
Warehouse No. 2	11,200
Warehouse No. 3	12,200
Warehouse No. 4	19,900
TOTAL FLOOR AREA OF MILL ABOUT	337,200 FEET SUPER.

SIDINGS.—Private sidings are laid and arrangements might be made with the railway company for a connection.

POWER AND LIGHTING.—Electric, generated by plant on site.

HEATING.—High and low-pressure steam and hot air systems.

WATER.—From public main and stream.

Further particulars, plan and permits to view may be obtained on application to the CHIEF VALUER, Lands and Factories Section, Disposal Board, Room 279, Caxton House, Tothill-street, Westminster, S.W.1. 8717

Board of Education.
APPOINTMENT OF ASSISTANTS AT THE SCIENCE MUSEUM.

The Board of Education invite APPLICATIONS for APPOINTMENT as ASSISTANTS on the HIGHER TECHNICAL STAFF of the Science Museum. There are two vacancies in this grade.

Applicants must be between the ages of 22 and 26 on the 1st June, 1922, but in exceptional cases applications from persons above the age of 26 on that date will be considered.

Candidates will be expected to have had a sound general training equivalent to that required for a University Honours Degree in Civil Engineering or Electrical Engineering. Experience of post graduate practical work will be regarded as an important qualification.

The commencing salary will be £200 per annum in the case of entrants under 25 years of age and £250 per annum in the case of entrants over that age, together with the usual Civil Service bonus. The persons appointed will be pensionable Civil Servants.

Further particulars of the appointment and forms of application may be obtained from the DIRECTOR and SECRETARY, Science Museum, South Kensington, London, S.W. 7.

Applications should reach the Department not later than 15th August, 1922. 8725

PUBLIC NOTICES

University of Liverpool.
FACULTY OF ENGINEERING.

DEAN: Professor T. H. ABELL, O.B.E., M. Eng., R.C.N.C. (Ret.), M. Inst. N.A.

Prospectus containing full particulars of the following may be obtained on application to the REGISTRAR :—Engineering, Electrical Engineering, Civil Engineering, Naval Architecture, Metallurgy, Geology, Marine Engineering, Design and Drawing, Refrigeration, Mathematics, Physics, Chemistry. 8711

Leeds University.
DEPARTMENT OF CIVIL AND MECHANICAL ENGINEERING.

The University Council will shortly proceed to the APPOINTMENT of a DEMONSTRATOR in MECHANICAL ENGINEERING. Works experience in addition to good academic qualifications essential. Salary £250.—Further particulars may be obtained from the REGISTRAR, The University, Leeds, by whom applications will be received up to the 24th July. 8722

University College of South WALES AND MONMOUTHSHIRE.
COLEG PRIFATHROFAOL DEHEUDIR CYMRU A MYNWY.

The Council of the College invites APPLICATIONS for the POST of PROFESSOR of ENGINEERING. Salary £1000 per annum.

Further particulars may be obtained from the undersigned, by whom twenty copies of applications with testimonials (which need not be printed) may be received on or before August 31, 1922.

D. J. A. BROWN,
Registrar.
University College, Cardiff,
June 30, 1922. 8709

University of Cape Town.
DEPARTMENT OF CIVIL ENGINEERING.

WANTED by 1st October, or as soon after as possible, a FIRST-GRADE MECHANICAL ASSISTANT in the CIVIL ENGINEERING LABORATORY.

Applicants must be good mechanics, and have had satisfactory workshop experience. The duties of the position are to work and repair the testing and hydraulic equipment in the laboratory, to lay down new plant, to make test specimens and accurate experimental apparatus, and, generally, to work under the instructions of the Professor. Experience in turning, fitting, and fine instrument work is essential.

Salary £350 a year, rising to £450 by annual increments of £25.

The appointment is probationary for the first two years.

An allowance of £40 will be made for passage money; pension rights are secured under the Government Teachers' Superannuation Fund, membership of which is compulsory; six months' leave of absence may be granted after six years' service, three months of which will be on full pay.

Applications, in triplicate, should be sent to the SECRETARY, Office of the High Commissioner for the Union of South Africa, Trafalgar-square, London, not later than 15th July, 1922. 8627

PUBLIC NOTICES

University of Glasgow.
CHAIR OF MINING.

The University Court proposes to consider the making of an APPOINTMENT to FILL the VACANT CHAIR on 21st July next or later date.

Information regarding the Chair may be obtained on application to the SECRETARY of the UNIVERSITY COURT, the University, Glasgow.
June, 1922. 8583

County Borough of Warrington.
ELECTRICITY DEPARTMENT.

The Electricity and Tramways Committee invite TENDERS for the following :—

A.—CAST IRON CIRCULATING PIPES.
B.—STEAM PIPES, FEED TANK, &c.

Specifications and form of Tender can be obtained from F. V. L. Mathias, Borough Electrical and Tramways Engineer, Howley, Warrington, on payment of One Guinea for each specification, which will be returned on receipt of a bona fide Tender. Five Shillings each will be charged for extra copies of either specification.

Tenders, addressed to the Chairman of the Electricity and Tramways Committee, Town Hall, Warrington, must be sealed with wax and endorsed "Tender for Cast Iron Circulating Pipes" or "Tender for Steam Pipes, Feed Tank, &c.," as the case may be, and delivered not later than Twelve o'clock Noon on Monday, July 24th, 1922.

Cheques to be made payable to the Borough Treasurer, Warrington.

The Committee do not bind themselves to accept the lowest or any Tender.

A. T. HALLAWAY,
Town Clerk.
Town Hall, Warrington. 8751

Guildford Gas Light and Coke COMPANY.

TENDERS are INVITED for the following PLANT, dismantled for larger size and FOR SALE on the Gasworks, Guildford :—

TWO 25 H.P. MARSHALLS' STEAM ENGINES, complete with Shafting, Pulleys, and Belts.
TWO STURTEVANT BLOWERS, outlet 18in. diameter.

Further particulars may be had from the Engineer at the Gasworks.

Tenders to be sent in by July 15th, 1922, and addressed "Chairman of the Gas Company, Gas Offices, Onslow-street, Guildford."

WILLIAM TITLEY,
Secretary.
8707

Liverpool Corporation Water-WORKS.
TRUNK MAIN FROM PRESCOT TO LIVERPOOL.—CONTRACT NO. 1.
TO IRON PIPE FOUNDERS.

The Water Committee of the Liverpool Corporation is prepared to receive TENDERS from manufacturers of iron pipes for the SUPPLY of about 6700 TONS of CAST IRON PIPES of 42in. and 40in. internal diameter, together with a number of SPECIAL CASTINGS, in accordance with a specification and drawings prepared by the Water Engineer, copies of which may be inspected at the Water Engineer's Office, Alexandra Buildings, 55, Dale-street, Liverpool, on and after Thursday, the 6th day of July, 1922. Copies of the specification and form of Tender may be obtained upon payment of a deposit of Two Guineas, which will be repayable upon receipt of a bona fide Tender and return of the documents and drawings issued.

Tenders, endorsed "Tender for Cast Iron Pipes," are to be sent through the post in a sealed envelope to the Town Clerk's Office, Municipal Buildings, Liverpool, addressed to the Chairman of the Water Committee, so as to be delivered not later than Twelve o'clock Noon on Tuesday, the 18th July, 1922.

The Water Committee do not bind themselves to accept the lowest or any Tender.

G. HAMMOND ETHERTON,
Town Clerk.
Municipal Buildings, Liverpool,
5th July, 1922. 8745

PUBLIC NOTICES

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
DRYING AND SUPERHEATING STEAM.

The Proprietor of British Patent No. 15,104 is PREPARED to SELL the PATENT or to LICENSE British Manufacturers to work under it. It relates to means for drying and superheating steam.

Address : B. W. & T.,
111 and 112, Hatton-garden,
8728 E.C. 1.

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
PUMPS.

The Proprietors of British Patent No. 105,851 are PREPARED to SELL the PATENT or to LICENSE British Manufacturers to work under it. It comprises the combination with a reciprocating or rotary piston pump of a centrifugal pump working in parallel therewith.

Address : B. W. & T.,
111/112, Hatton-garden,
8701 London, E.C. 1.

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
MOTOR TRACTORS.

The Proprietors of British Letters Patent No. 138,846 are PREPARED to SELL the PATENT or to LICENSE British Manufacturers to work under it. It relates to motor tractors with propulsion levers which act as feet. Three propulsion levers driven from a three-throw crank shaft provide continuous working of the tractor.

Address : B. W. & T.,
111/112, Hatton-garden,
8702 London, E.C. 1.

Madras and Southern Mahratta RAILWAY CO., LTD.

The Directors are prepared to receive TENDERS for :
(1) 380 CWT. BOLTS, NUTS AND RIVETS ;
(2) LAMP FITTINGS AND MISCELLANEOUS GLASS (Burners, Plate and Sheet Glass, &c.);
(3) 65,625,000 RAILWAY TICKETS (Blank) ;
(4) WOOD SCREWS, NAILS, PINS, &c. (Iron and Brass) ;

in accordance with the specifications which may be seen at the offices of the Company. The charge for each specification Nos. 2, 3, and 4 is One Guinea, and for No. 1 Half Guinea, which in all cases is not returnable.

Tenders must be sent in, addressed to the SECRETARY, not later than 2 p.m. on Tuesday, 18th July, 1922, marked "Tender for Bolts, Nuts and Rivets," or as the case may be.

The Directors do not bind themselves to accept the lowest or any Tender.

Company's Offices :
25, Buckingham Palace-road,
Westminster, S.W. 1,
30th June, 1922. 8719

The South Indian Railway COMPANY, Limited, are prepared to receive TENDERS for the SUPPLY of :—
WHEELS AND AXLES FOR ROLLING STOCK.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tenders for Wheels and Axles for Rolling Stock," must be left with the undersigned not later than Twelve Noon on Friday, the 28th July, 1922.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of £1 for each copy of the specification.

Copies of the drawings may be obtained at the office of Messrs. Robert White and Partners, Consulting Engineers to the Company, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.
91, Petty France, S.W. 1,
6th July, 1922. 8736

The South Indian Railway COMPANY, Limited, are prepared to receive TENDERS for the SUPPLY of :—
COPPER RODS.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tenders for Copper Rods," must be left with the undersigned not later than Twelve Noon on Friday, the 21st July, 1922.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of the specification.

Copies of the drawings may be obtained at the office of Messrs. Robert White and Partners, Consulting Engineers to the Company, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.
91, Petty France, S.W. 1,
6th July, 1922. 8737

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PUBLIC NOTICES

Royal Burgh of Kirkcaldy.

ELECTRICITY WORKS, VICTORIA-ROAD.

The Provost, Magistrates and Council invite TENDERS for the following WORK:—

SPECIFICATION NO. 3.—STEEL WORK FOR BUILDING ANNEXE.

A copy of the specification can be seen at and obtained from the offices of Messrs. Kennedy and Donkin, 8, Broadway, Westminster, S.W. 1, on and after Monday, July 10th, upon payment of a deposit of £2 2s. (cheque, postal or money order). An additional copy of the specification can be obtained upon payment of a deposit of £1 1s. These deposits will be returned after the receipt of a bona fide Tender and on the return of the specification.

Tenders, on the prescribed form, enclosed in sealed envelopes and addressed on the outside "Electricity Supply, Tender to Specification No. 3," must be delivered at the office of the undersigned not later than 10 a.m. on Thursday, 20th July, 1922.

The Council do not bind themselves to accept the lowest or any Tender.

W. L. MACINDOE, Esq.
Town Clerk's Office, Kirkcaldy,
July, 1922. 8738

State Electricity Commission
OF VICTORIA.

TENDERS FOR PLANT.

TENDERS are hereby INVITED for the SUPPLY, DELIVERY, &c., of the following for the Morwell Power Scheme.

Copies of Tender form and specification will be available upon application to—

Agent-General for Victoria,
Melbourne-place, Strand,
London, W.C. 2.

SPECIFICATION NO. 261.—STRAIN and PIN TYPE INSULATORS.

CHARGE.—£2 2s. for the first three copies of Tender form, conditions of contract, specification and drawing complete. These charges will be returned on receipt of a bona fide Tender. A fourth copy and any further copies will be supplied for the sum of 10s. 6d. each.

PRELIMINARY DEPOSIT.—A preliminary deposit of £100 is to be lodged with Tender.

The specifications may be inspected at the above-mentioned office.

The Commission does not bind itself to accept the lowest or any Tender.

Tenders, on prescribed form, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than Noon, 16th September, 1922.

R. LIDDELOW,
Secretary,
State Electricity Commission of Victoria,
8580 Melbourne, Victoria, Australia.

The Great Indian Peninsula
RAILWAY COMPANY.

The Directors are prepared to receive TENDERS for the SUPPLY of the following STORES, namely:—

No.		Fee for Specification.
1.	STEEL TYRES FOR CARRIAGES AND WAGONS	£1
2.	CAST IRON WATER PIPES, &c.	10s.

Specifications and forms of Tender may be obtained at this office on payment of the fee for the specification, which payment will not be returned.

The fee should accompany any application by post. Cheques and postal orders should be crossed and made payable to the Great Indian Peninsula Railway Company.

Tenders must be delivered in separate envelopes, sealed and addressed to the undersigned, marked "Tender for Steel Tyres for Carriages and Wagons," or as the case may be, not later than Eleven o'clock a.m. on Tuesday, the 18th July, 1922.

The Directors do not bind themselves to accept the lowest or any Tender.

R. H. WALPOLE,
Secretary.
Company's Offices,
48, Copthall-avenue, E.C. 2,
London, 5th July, 1922. 8742

Aberdeen Waterworks.

WATERWORKS ASSISTANT WANTED IMMEDIATELY; thoroughly experienced in the design and construction of Aqueducts and Reinforced Concrete Work. Salary £330. Send testimonials, chronological statement of career, age, and state of health, &c.

GEORGE MITCHELL, M. Inst. C.E.,
8753 Water Engineer.

SITUATIONS OPEN

P5429.—Applicants are Thanked and the APPOINTMENT has been MADE. P5668 A

WANTED, a TECHNICAL SALESMAN for South Africa, experienced in drawing up and suggesting applications for the use of Ball and Roller Bearings in all types of Machinery and Line Shafting.—Address, stating age, qualifications, and salary required, 8613, The Engineer Office. 8613 A

WANTED, ADVERTISEMENT and PUBLICITY EXPERT, to Prepare Catalogues, Circulars, Advertisements, Announcements, &c., Steam, electric and mining experience desirable.—Applications, stating age, full experience, and salary required, must be made on sheets written on one side only, in envelopes marked in left-hand top corner "A.P.X.," addressed to ROBERT A. HOPKINSON, Chairman and Managing Director, Messrs. J. Hopkinson and Co., Ltd., Makers of Patent Safety Boiler Mountings and Valves, Britannia Works, Huddersfield. 8590 A

WANTED, an Experienced ROPEWAY ENGINEER, capable of laying out plants on all systems and with full experience of design and detail of all parts.—Address applications, giving experience and salary, 8610, The Engineer Office. 8610 A

WANTED Shortly, an Experienced MAN for the North of England, with commercial knowledge of the import of iron ore and semi-manufactured goods as blooms and billets. Applicants should state age, experience, present employment, which will be treated in confidence, and remuneration desired.—Address, 8747, The Engineer Office. 8747 A

CONTRACTORS' AGENT.—Owing to Ill-health a new AGENT is REQUIRED for the execution of Heavy Sewer Work (18 months' contract) under L.C.C. Only first-class men with good experience of similar work need apply. Good prospects of permanency to suitable man.—W. G. TARRANT, Ltd., Contractors Byfleet, Surrey. 8739 A

EXPERIENCED TECHNICAL ENGINEER and DESIGNER WANTED. Applicants must be fully conversant with and possess up-to-date knowledge of Horizontal and Vertical Gas, Oil and Spirit Engines, particularly the Cold Starting Horizontal Semi-Diesel Type.

State age, experience, salary required, sending copies of references.

Applications, which will be treated confidentially, to be received not later than July 13th, addressed to

SIR ROBERT CLOUGH, M.P.,
Governing Director,
8743 A Keighley Gas and Oil Engine Co., Ltd., Imperial Works, Keighley.

FIRST-CLASS MANAGER WANTED IMMEDIATELY for large new wet process rotary kiln cement plant in India nearing completion. First-class salary will be paid to the right man, preferably one having had varied cement works experience.—MAXTED and KNOTT, Ltd., Consulting and Cement Works Engineers, Burnett-avenue, High-street, Hull. 8635 A

OLD-ESTABLISHED FIRM of ENGINEERING SPECIALISTS is OPEN to APPOINT RESIDENT REPRESENTATIVES in Yorkshire, Lancashire, Northumberland; applicants with energy, initiative and sales capacity. Send full particulars.—Address, 8744, The Engineer Office. 8744 A

KNOWLE MENTAL HOSPITAL.—WANTED, a WORKING ASSISTANT ENGINEER, age not exceeding 35 years. Candidates must be good mechanical engineers and electricians. Salary £200 a year and house.—Applications, stating age and giving full particulars of experience and qualifications, together with copies of three recent testimonials, to be sent to the CLERK to the VISITING COMMITTEE, Knowle Mental Hospital, Fareham, Hants, not later than July 18th, 1922, marked "Application for Assistant Engineer." P5706 A

PROCESS ENGINEER REQUIRED for Large Turbine and Electrical Work; also PROCESS ENGINEER for Electrical Details (Meters and Instruments). Applicants for the above positions must be thoroughly competent in detailing out operations and times direct from drawings, and possess the necessary practical experience to establish operations and times in the shops. State experience in full, age, and salary required.—Address, 8723, The Engineer Office. 8723 A

REPRESENTATIVE in Every Country for the Sale of the most reliable and up-to-date Quick-grip Engineers' and Woodworkers' Vices, British manufacture. State full particulars of qualification, &c., with references.—Address, P5677, The Engineer Office. P5677 A

REQUIRED by an Important Company, an ASSISTANT BUYER, with experience in Purchasing Engineering Plant and Machinery, preferably also with Shops Experience. Salary £300, with scope for advancement.—Reply, stating age, education, and experience, to Box B., c/o Regent Advertising Service, Ltd., 4, London Wall-buildings, London, E.C. 2. P5714 A

TRANSFORMER DESIGNING ENGINEER.—APPLICATIONS are REQUESTED for the APPOINTMENT of TRANSFORMER DESIGNER with well-known British firm of electrical engineers.

Applicants must have had first-class experience in the design and manufacture of large High-tension Transformers.

The position would be a permanency and offers ample scope to a suitable man. Applications will be treated with strict confidence.

Address, 8724, The Engineer Office, giving full particulars of experience. 8724 A

WORKS MANAGER REQUIRED by Large Midland Firm of Structural Engineers and Colliery Screening Plant Manufacturers. A first-class energetic man required, ex-Service preferred.—Address, 8587, The Engineer Office 8587 A

WORKS UNDER-MANAGER REQUIRED, to Take Entire Charge of Plumbers' Department at North-East Coast Shipyard and Engine Works. Applicants must have had good experience of plumber work on passenger and cargo ships.—Address, giving full particulars, 8700, The Engineer Office. 8700 A

YOUNG MAN REQUIRED for Sales Office (Victoria) by Manufacturers of Electrical and Engineering Instruments. Must have had good education and engineering training. Progressive position is offered to suitable applicant. Send full particulars.—Address, 8746, The Engineer Office. 8746 A

WANTED AT ONCE, First-class DRAUGHTSMAN thoroughly experienced in the Design of all sizes of Electric Cranes. Preference given to one who has had considerable practice in estimating. State age, experience, and salary required.—Address, 8538, The Engineer Office. 8538 A

WANTED AT ONCE in City, CHIEF DRAUGHTSMAN, experienced in Structural Work and Handling Plants. Required for office of about 25 draughtsmen. Must be really first-class, capable of organisation, economic production, strict discipline and control.—Address, stating age, qualifications, experience, salary required, 8735, The Engineer Office. 8735 A

CRANE DRAUGHTSMAN WANTED, with Good general experience and special knowledge of Electric Derricks, Overheads, and Travelling Jib Cranes; able to take charge if necessary.—Apply, the MANAGING DIRECTOR, The Anderson-Grice Co., Ltd., Carnoustie. 8741 A

REQUIRED, FOREMAN PATTERNMAKER for Engineering Works. Must be a thorough up-to-date reliable man with first-class experience of all classes of patterns, small to medium, also plate moulding.—Write, stating age, experience, and salary expected, to "PATTERN," c/o West End Advertising Agency, Ltd., 195, Oxford-street, London, W. 1. P5686 A

TWO ENGINEER FOREMEN for Large Industrial Manufacturing Works, to Take Charge of Production Plant. Working shifts. Men having held similar position before preferred. State age, wages, and references.—ENGINEER, Box K280, Lee and Nightingale, Advt. Offices, Liverpool. P5674 A

WANTED for Amusement Park and General Breakdown Work, progressive Young Man PRACTICAL FITTER with some drawing-office experience. Must have served his time in workshop. Live, energetic men only need apply.—Forward copies of testimonials and state experience, age, and wages required to BLACKPOOL PLEASURE BEACH, Limited, Pleasure Beach, Blackpool. 8749 A

REQUIRED in Engineering Works, a MAN to Take Charge of and Operate Worm Gear Hobbing Machines. Applicants must have had good practical and technical experience and be capable of securing best results.—Write, stating age, experience, and salary expected, to "WORKS," c/o Dixon's, 195, Oxford-street, London, W. 1. P5685 A

SITUATIONS WANTED

A BUYING, SALES or FACTORY POST REQUIRED; qualified experienced engineer, age 34, expert mechanical man, factory or transport organiser, disciplinarian; can introduce business.—Address, P5667, The Engineer Office. P5667 B

AS WORKS MANAGER, Thoroughly Practical, well educated ENGINEER, with sound experience in loco., steam, general engineering, millwrighting, ironfoundry and repair work. Past 22 years successful control of labour as foreman and works manager.—Address, P5608, The Engineer Office. P5608 B

ASSISTANT TO MANAGING DIRECTOR, ENGINEER OR SECRETARY.—A.M.I.C.E., aged 40, SEEKS POST; late Squadron Leader, R.A.F., had charge of drawing-office, works and office staffs. Knowledge of bookkeeping, cost accounts, secretarial duties, company law; willing to work one month without salary to prove ability if prospects good.—H. A. C., Smith's Library, Broadway, Ealing. P5649 B

BUYER.—The MANAGER of a Large Engineering Works Purchasing Dept., who has an exceptionally wide knowledge of the markets of the country, DESIRES to NEGOTIATE NEW APPOINTMENT.—Write, Z. M. 615, c/o Deacon's, Leadenhall-st., E.C. 8644 B

CONTRACTOR'S ENGINEER OPEN for RE-ENGAGEMENT. First-class experience, structural steel work, reinforced concrete, earthworks, underpinning, &c. Good organiser, large or small contracts. Keen costs. Age 29. Present job at close.

All duties of engineer or agent. Unimpeachable references.

Address, P5709, The Engineer Office. P5709 B

DROP FORGE MANAGER, 25 Years' Experience, good organiser, able to get production, up to date in modern methods, 10 years' experience U.S.A., DESIRES POST, either home or abroad.—Address, P5684, The Engineer Office. P5684 B

ENGINEER, Good Experience, Office and Shops, hydraulic, structural, cranes, hoists, buildings, furnaces, lay-outs, steam. Temporary taken.—Address, P5699, The Engineer Office. P5699 B

ENGINEER, Late Manager Small London Works, SEEKS ANY POST where 30 years' general experience, organising ability, tact and initiative are of value.—SNOAD, 36, York-road, Hitchin. P5704 B

ENGINEER (Mech.), Home or Abroad; Hoisting machinery, furnace charging gear, gas producers, steel works plant and pumps; fluent French; excellent refs.—Address, P5701, The Engineer Office. P5701 B

ENGINEER (28), 5 Years Shops and Technical Experience, SEEKS APPOINTMENT as Works Engineer or Assistant Works Manager at home or abroad.—Address, P5679, The Engineer Office. P5679 B

ENGINEER (35), with Experience in Crushing, grinding and concentrating machinery and plants, commercial and technical, DESIRES APPOINTMENT; fluent French.—Address, P5683, The Engineer Office. P5683 B

ENGINEER (36), Late Manager Small Works, Charge D.O., 7 years, general engineering, steam, petrol, plant, railway tracks, SEEKS any POST anywhere. Moderate salary.—Address, P5605, The Engineer Office. P5605 B

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For continuation of Small Advertisements see page 3.

JULY 7, 1922.—VOL. CXXXIV

THE ENGINEER.

JUNE.

Railway Accidents in 1921.

AT no period in the history of railways has so favourable an annual return of railway accidents appeared as that for 1921, which was published on the 16th of the month. Last year was admittedly one of considerably reduced passenger and goods carriage. There was an almost complete cessation of the mineral traffic during April, May and June, which reflected upon the general merchandise traffic also. Then came the industrial slump in the autumn. Consequent on these conditions, the total train mileage for the whole of the United Kingdom experienced a decrease, when compared with 1920, of 16.32 per cent. The influence on the passenger traffic is indicated by a decrease of 22.31 per cent. in the number of journeys; but despite the decrease in the number of passengers carried, there was an increase in the passenger train mileage. To get a better idea of the situation during the year, it should be said that the thirteen principal British companies showed a decrease of 24.26 per cent. in goods train mileage and of 25.11 per cent. in goods train shunting mileage. The decrease in the number of accidents was, however, greater even than these figures would lead us to expect, and, what is both remarkable and gratifying our inquiries among the railway companies show that the decreases were spread over the whole year, and not confined to the April–June quarter, when traffic was at its lowest.

Port of Tangier.

THE diplomatic protest of the British Government against the conditions under which contracts have been given out for the construction of the port of Tangiers has awakened interest in a state of things that bids fair to secure for the French a monopoly of public works in that town. It is, of course, very necessary that something should be done to take advantage of the specially favoured geographical situation of Tangier to develop a trade which has languished for years on account of the inability of the three countries which exercise jurisdiction over the international zone to come to an understanding. It was hoped that the negotiations to be carried out this month for creating a new "statute" for Tangiers would settle the conditions under which the port would be constructed, but the French Government anticipated the agreement to hold over the discussion on public works until the coming conference by authorising the Sultan to grant a concession to a French company for the construction of the port. The concession was granted a year ago, and the company is now giving out orders to French firms for the work. The French Government argues that the Sultan of Morocco has a perfect right to grant concessions in a territory over which he has full sway; but, as a matter of fact, the Sultan can do nothing without the consent of the French Government, and in any case he has no jurisdiction over the town which has been internationalised. It would appear that the French action would result in the coming Conference being faced by an accomplished fact, and it remains for the British Government to see that the interests of British manufacturers, who have equal rights in Tangier with the French, are preserved.

The S.S. Empress of Australia.

DURING the month we described briefly the new Canadian-Pacific liner the Empress of Australia, and elsewhere in the present issue further particulars of her propelling machinery are given. This ship, which recently left the Clyde for Vancouver and passed through the Panama Canal early in July, is a vessel the performance of which will be watched with great interest, since she is the first large ocean-going liner to be fitted with Föttinger transformers. The Föttinger transformer came into prominence at a time when the steam turbine had just achieved its first marine success, and shortly before the war it was looked upon as one of the most important developments in transmission and reduction machinery. In our own country Yarrow and Co., Limited, of Scotstoun, Glasgow, had already under construction in 1914 two large torpedo destroyers, which were to be fitted with Diesel engines driving through Föttinger transformers, but they were not completed as originally planned, owing to the outbreak of war and the non-delivery of the transformers. During the war considerable progress was made by the Vulcan Works at Stettin and Hamburg, which not only equipped three torpedo destroyers with two-shaft propelling machinery of 12,500 horse-power per shaft and a small cruiser with similar machinery of 20,000 horse-power per shaft, but also had under construction 30,000 horse-power Föttinger transformer sets for battleships. The machinery of the ex-Tirpitz—now the Empress of Australia—remains at present the only large installation in commercial service, but the results obtained from the transformers already constructed would seem to indicate that in spite of the lower efficiency as compared with toothed gearing, there are compensating advantages, particularly for large outputs, on account of the small size of the transformer, its small weight and its comparatively large astern power.

The East Horndon Locomotive Failure.

THE report of Major Mount to the Ministry of Transport on the accident of January 11th last at East Horndon was issued during the month. The accident in question, whereby the driver was killed and the fireman seriously injured, was caused by the failure of the right-hand connecting-rod, and the report had been awaited with interest, because, although failures of the kind are unusual, a similar accident, but without serious results, occurred on the Midland on the previous day, and since then two other cases of broken connecting-rods on another railway have been reported. In the East Horndon case there was a fracture of the little end strap. There were signs of a concealed flaw on the inside of the bend at the top of the strap, just clear of the radius, but the flaw probably did not reach the surface. When the fracture occurred the strap was pulled over the crosshead pin, thus releasing the brasses. The rod and the little end strap would then be free to pivot about the crank. A fracture at the small end of the rod then took place, after which the rod evidently swung down and struck the sleepers, when a piece 18in. in length was broken off. The fire-box was then pierced at the foundation ring, and a piece 5in. in length broken off the rod, after which a second perforation of the boiler occurred. The accident raised doubts as to the thoroughness of the inspections, but there was no evidence to show that they were not done properly; in fact, Major Mount observed that in seeking for the primary cause of the failure, carelessness or lack of examination on the part of the inspection and repair staff could be eliminated.

Exchange Stability.

THE various industrial and economic congresses that have been held in France during the month have helped to clear the situation, and will, it is hoped, do something to prepare the way for a recovery of foreign trade in the early future. It is now admitted that it would be a serious mistake to attempt any measures which would aim at suddenly bringing back the exchange rate to a normal level. Wages and living costs in the country have been adjusted more or less to currency values as represented by the rate of exchange, and if the rate were rapidly improved everything would be disorganised to an extent that would cause far more harm to trade than the present exchange rate fluctuations. The outcome of the Money Congress was a series of resolutions, of which the most important was in favour of creating an organisation which would ensure the stability of the exchange rate over certain periods. If the rate can be stabilised there will be much greater facilities for business, and the situation will be nearly as good as in normal times, provided the country modifies the present fiscal policy, which is admittedly carried out for the protection of home industries. The results of that policy so far have been a stagnation of trade, and even French manufacturers now see that they must do business with foreign countries, and that it can only be done on a basis of reciprocity. There is obviously a tendency towards a more liberal commercial policy in France which may, in course of time, result in greater facilities for foreign trade, and as such trade would, of itself, help to strengthen confidence and improve the exchange rate, there is hope that the rate will be stabilised more or less in the way suggested by the Money Congress, and that the present disparity will be progressively reduced.

End of the Engineering Dispute.

ON the second day of the month the dispute in the engineering trades, which had lasted for nearly thirteen weeks, came, virtually, to an end. On that day the result of the renewed ballot taken by the forty-seven unions was made known. It showed that well over ninety-nine thousand members favoured acceptance of the employers' terms, whilst less than forty-seven thousand desired to reject them. The net majority was 52,432, and the Executives of the unions immediately instructed their men that the struggle was at an end, and that the lock-out against these unions—which began on May 3rd—would be lifted immediately. The boilermakers and foundrymen had refused to take part in the ballot, and remained out, and the Amalgamated Engineering Union was still recalcitrant. That union had, however, got so far at a conference held in York as to decide that a new ballot should be taken. Mr. Brownlie told the men that the union was in a parlous financial position, and that an early termination of the dispute was imperative. In these circumstances it was not surprising that when the result of the new ballot was declared it was found that a substantial majority had voted in favour of acceptance of the terms. Thus, the men of the A.E.U. also applied for work. In the face of these events, the boilermakers and foundrymen could not hold out, and by about the middle of the month they, too, gave in, and peace in the engineering industry was restored.

Automatic Train Control.

THE serious collisions at Wigan and Kirtlebridge, both occurring on December 19th, 1916, showed the necessity for an inquiry into the merits of automatic train control as a safeguard against drivers passing signals at "danger." On July 17th, 1920, there were again two collisions due to the same cause, in one of which five passengers were killed. This accident evidently brought matters to a head, and three months later the Ministry of Transport appointed a Departmental Committee on Automatic Train Control. The report of that body was issued on the 21st of the month. The members held twenty-eight general meetings, and, in addition, a sub-committee was engaged on certain technical details, such as examining and reporting upon of no less than 200 "inventions." The Committee considers that a *primâ facie* case is made out for train control, since it would have a preventive effect, not obtainable by any other means, upon an estimated number of about one hundred accidents a year. It holds that

control at stop signals is of more importance than control at distant signals only, but recognise that, owing to inadequate braking power on some trains and owing to its value for localising purposes in foggy weather, control should also be applied at distant signals. The Committee estimates that the first cost for a complete scheme would be about £4,660,000, and the upkeep £40,700 a year. The report concludes with a recommendation that the companies should appoint a committee of experts to standardise the track and locomotive fittings, so that an engine could be controlled at any point whether on its own or another company's line.

The Threat of a Water Famine.

A GOOD deal of alarm, largely occasioned by ill-informed articles in the daily Press, was felt during the month concerning the threat of a water famine, as the result of lack of rainfall. As a fact, much of the anxiety experienced was groundless, though there were, and are still, parts of the country with restricted supplies, by reason, to a great extent, of last year's insufficient precipitation. The rains and low temperature of the last fortnight of the month greatly improved the position in many parts, both by increasing reserves and by lessening the consumption. At the same time, it cannot yet be said that all necessity for care in the use of water has ceased to exist in all districts. In the London area we have the assurance that all the reservoirs in the Thames Valley are full, while those in the Lea Valley have only been drawn upon to a comparatively small extent, so that there is no reason to fear any immediate curtailment in supplies, much less an actual famine. It has to be remembered, however, that both the Thames and the Lea are, to a considerable extent, fed from springs, and that the springs, because they have not been adequately replenished after the draught made upon them last year, are lower than usual, and are not contributing their average quota to the streams. The wells, too, from which the Metropolitan Water Board obtains a proportion of its supply, are lower than is customary. Hence, though there is absolutely no ground for panic, and though there are no signs of anything approaching a famine or even of restrictions in the near future, it behoves everyone to exercise due care in the consumption of water and to see to it that there is no waste and no unreasonable use of it. This line of action is desirable, not only in the Metropolis, but in other parts of the country in which rainfall has been deficient.

French Hydraulic Schemes.

A CONGRESS held in Bordeaux last month dealt fully with the hydraulic schemes to be carried out in the south-eastern departments of France. While those schemes form only part of the programme for the electrification of the country, they are, nevertheless, the most important, and include such undertakings as the electrification of the Midi Railways, the construction of the Midi Canal and the utilisation of the hydraulic power of the Dordogne. So much has been said about the electrical side of the programme that the value of the inland navigation improvements appears to be overlooked. It is proposed to create four main water arteries, which will permit of navigation by boats of at least 1200 tons, and they all aim at diverting traffic from Central Europe to the French seaboard, and at the same time of allowing cheap carriage of raw material to the works and factories and of iron ore and certain classes of manufactured goods to the ports for shipment. When the Rhone has been "canalised" there will be direct communication between Switzerland and Marseilles, while the connecting up of the Rhone with the Rhine will extend navigation facilities to the whole of the vast waterway system of Germany. The canals through the industrial districts in the north of France are to be linked up to divert traffic to Dunkirk, and with the proposed deepening of the Moselle there will be water communication between the northern port and the Rhine. Another scheme that is making slow but sure headway is the extension of the canal from the Department of the Rhone to Nantes, so that the great manufacturing region of Lyons and neighbourhood may send goods by water for shipment. Of still more importance is the construction of the Midi Canal, which is to connect the Mediterranean with the Atlantic, and although its commercial value was debated for many years before the war, it was finally sanctioned and the want of funds alone prevented the undertaking from being carried out. The Bordeaux Congress strongly insisted upon the necessity of Parliament voting credits for the construction of the Midi and lateral canals, and at the same time urged that the State should encourage experiment with simple methods of boat propulsion that will not damage the canals.

Atmospheric Pollution.

By JOHN B. C. KERSHAW, F.I.C.

THE figures and information contained in the seventh report of the Advisory Committee on Atmospheric Pollution, which has been published recently by the Meteorological Office (M.O. 249, 1922), cover the year ending March 31st, 1921. The preceding reports all contained matter of interest, but this one derives additional value and interest from the fact that a Bill for increasing the powers of both the Ministry of Health and the municipal authorities in connection with the suppression of black smoke, is now under the consideration of Parliament. The provisions of this Bill are based upon the recommendations of Lord Newton's Departmental Committee upon the Abatement of Smoke and Noxious Vapours, which began its sittings before the war and has only recently completed its labours, and there appears to be no doubt that if the pressure of parliamentary business will permit, the Bill will pass this session.

This seventh report deals with observations made in twelve cities and towns, in which thirty-one soot and dust gauges were installed. In addition to these thirty-one gauges of the standard type, described more than once in our columns, automatic apparatus for measuring suspended impurity has been set up at four different centres in London, and also in Glasgow and Rochdale. These instruments for measuring suspended impurity, however, have only been in operation a few months, and comparative data for the year are not included in the present report. The results of the dislocation and suspension of observations caused by the war have not yet been completely overcome, for the report states that although there are three stations in Birmingham, they ceased operations entirely during the war, and only began again in January, 1920. Rochdale and Newcastle-on-Tyne recommenced observations in October, 1919, and Kingston-upon-Hull in November, 1919. The figures for the last three stations are not, therefore, available for comparison with those for the summer of 1920. Stirling sent only two records during 1919, for October and November, hence no comparison could be made with the present year. The two stations which were referred to in the last annual report as about to begin observations at Wishaw and Worthing, have not yet been in a position to do so.

Following the custom adopted in previous years, readers are referred to the issues of the *Lancet* for the more detailed figures, and only summaries of some of the more important results and figures are given in the report under review. Table I. gives the detailed figures of the deposits from two selected stations—Rothamsted, as representing low deposits, and Birmingham Central, high deposits. The choice of Rothamsted in place of Malvern for this comparison was due to the fact that the returns were more complete from the former place, and that as regards purity of atmosphere, there is not much difference between the two places.

TABLE II.—*Total Solid Deposit at all Stations for the year 1920–21.*

Station.	Mean monthly deposits. Metric tons per sq. kilom.	Mean monthly deposits. Tons of 2240 lb. per sq. mile.	Total solids. Tons per sq. mile deposited in year ending March, 1921.
London—			
Meteorological Office	11.26	28.8	346
Archbishop's Park	11.81	30.2	362
Finsbury Park	7.48	19.1	229
Ravenscourt Park	9.04	23.1	277
Southwark Park	12.19	31.2	374
Victoria Park	7.92	20.3	244
Wandsworth Common	8.24	21.1	253
Golden Lane	11.42	29.2	350
Average for eight London stations	9.92	25.38	304
Glasgow—			
Alexandra Park	8.20	21.0	252
Bellahouston Park	9.54	24.4	293
Blythswood-square	14.44	37.0	444
Botanic Gardens	11.29	28.9	357
Queen's Park	8.42	21.5	258
Richmond Park	12.00	30.7	368
Ruchill Park	9.05	23.2	277
Tolcross Park	11.70	29.9	359
Victoria Park	9.74	24.9	299
Average of nine Glasgow stations	10.48	26.84	323
Birmingham—			
Aston	12.36	31.5	378
Central	21.18	54.2	650
South-Western	5.41	13.8	166
Average of three Birmingham stations	12.98	33.2	398
Southport—			
Hesketh Park	6.11	15.6	187
Woodvale-Moss	5.50	14.1	169
Average of two Southport stations	5.80	14.85	178
Other towns—			
Rochdale	24.85	63.6	763
St. Helens	12.37	31.65	380
Rothamsted	4.22	10.80	129
Kingston-upon-Hull	13.53	34.60	415
Newcastle-upon-Tyne	17.39	44.50	534
Liverpool	17.18	44.00	528

their mean monthly deposit, which is expressed as metric tons per square kilometre :—Rochdale, 24.85; Birmingham (Central), 21.18; Newcastle-on-Tyne, 17.38; Liverpool, 17.18; Blythswood-square, Glasgow, 14.44; Kingston-upon-Hull, 13.53; St. Helens, 12.37; Birmingham (Aston), 12.36; Southwark Park, London, 12.19; Richmond Park, Glasgow, 12.00; Archibishop's Park, London, 11.81; Tolcross Park, Glasgow, 11.70; Golden-lane, London, 11.42; Botanic Gardens, Glasgow, 11.29; Meteorological Office, London, 11.26; Victoria Park, Glasgow, 9.74; Bellahouston Park, Glasgow, 9.54; Ruchill Park, Glasgow, 9.05; Ravenscourt Park, London, 9.04; Queen's Park, Glasgow, 8.42; Wandsworth Common, London, 8.24; Alexandra Park, Glasgow, 8.20; Victoria Park, London, 7.92; Finsbury Park, London, 7.48; Southport (Hesketh Park), 6.11; Southport (Woodvale Moss), 5.50; Rothamsted, 4.22.

TABLE I.—*Comparison of Monthly Deposits at Two Selected Stations—Birmingham (Central) and Rothamsted.*

Month.	Station.	Rainfall in millimetres	Metric tons per square kilometre. Insoluble matter. Carbonaceous other than tar	Insoluble matter. Ash.	Soluble matter. Loss on ignition.	Soluble matter. Ash.	Total solids.
April, 1920	Birmingham	100	3.39	10.12	1.64	4.99	20.32
	Rothamsted	88	0.45	0.54	1.75	1.03	3.77
May	Birmingham	65	3.94	13.23	1.45	3.41	22.14
	Rothamsted	32	0.67	0.96	0.96	1.33	3.92
June	Birmingham	74	5.20	13.95	1.32	4.16	24.87
	Rothamsted	48	0.58	0.79	1.05	1.60	4.02
July	Birmingham	90	5.26	13.43	2.11	4.22	25.15
	Rothamsted	117	0.65	1.52	1.41	2.09	5.67
August	Birmingham	50	6.42	13.76	1.46	3.48	25.25
	Rothamsted	32	0.40	0.68	0.39	1.65	3.12
September	Birmingham	52	4.99	15.85	1.86	4.40	27.28
	Rothamsted	51	0.43	0.63	0.92	2.12	4.10
October	Birmingham	60	6.18	16.60	1.74	4.22	28.93
	Rothamsted	37	0.40	0.67	1.40	2.11	4.58
November	Birmingham	18	3.99	9.09	1.63	3.38	18.24
	Rothamsted	41	0.48	0.76	1.24	1.95	4.43
December	Birmingham	60	3.62	6.92	1.61	4.42	16.67
	Rothamsted	49	0.61	0.83	0.69	3.02	5.15
January, 1921	Birmingham	58	2.12	8.43	1.28	3.62	15.57
	Rothamsted	60	0.37	0.43	0.71	2.84	4.35
February	Birmingham	3	2.84	9.18	0.80	2.10	15.04
	Rothamsted	5	0.70	0.40	0.75	1.89	3.34
March	Birmingham	27	2.46	7.90	1.29	2.88	14.67
	Rothamsted	25	0.46	0.61	1.06	2.11	4.24

The chief features of this table are the very much higher figures returned for total solids from Birmingham, and the fact that this difference of pollution in the city atmosphere is chiefly due to the insoluble matter returned under "carbonaceous matter" and "ash," rather than to "soluble impurities." It is, of course, the larger amount of insoluble impurity which causes the haze and dirtiness of our city atmospheres, and when we have reduced this to the amount found in places like Rothamsted and Malvern, we shall have taken a long step towards brightening up life in our cities.

Table II. gives the total solids deposited monthly at all stations, and the following list contains all the stations shown in the table, arranged in the order of

These figures show what remarkable differences there are between the amount of atmospheric pollution in the cities and industrial towns and even between different districts of the same city. It will surprise some to learn that Rochdale is twice as dirty as St. Helens from the smoke reformer's point of view, and that the air of certain districts of London and Glasgow is far cleaner than that of the industrial towns of the Midlands and the North. How far these discrepancies are due to the position selected for the

soot and dust gauges cannot be determined from the information given in this report. It is possible that where towns have only one gauge installed—as at St. Helens—the municipal authorities will be careful to select a locality that is calculated to produce a rather more favourable deposit than is really justified by the state of their atmosphere. The writer spent many years in the early part of his life in that salubrious town, and he can speak with some practical knowledge when he states that at least four soot and dust gauges would be required to give any true representation of the atmospheric pollution of St. Helens.

In order that the figures given in the above list may be compared with those given in former articles on this subject which have appeared in THE ENGINEER, they have been converted into tons per square mile, and have been multiplied by 12 in order to ascertain the total fall of solids in twelve months, and are given in Table III.

TABLE III.—*The Total Deposition of Solid Matter, in Tons per Square Mile, for Five Years' Observations.*

Name of town or city.	1914–15.	1915–16.	1916–17.	1917–18.	1920–21.
Rochdale	—	—	749	1069	763
Oldham	957	901	—	—	—
Bolton	669	521	—	—	—
Birmingham (Central)	—	—	—	—	650
Newcastle-on-Tyne	477	517	713	639	534
Liverpool	574	588	—	—	528
Manchester (Technical Schools)	540	648	603	430	—
Leicester	—	454	377	427	—
Birmingham (average of three stations)	—	—	—	—	398
St. Helens	—	—	—	627	380
London (Golden-lane)	394	454	356	398	350
Glasgow (average of nine stations)	—	409	368	438	323
London (average of seven stations)	342	451	427	431	304*
York	277	243	261	—	—
Rothamsted	—	—	—	—	129
Malvern Wells	65	55	90	80	—

* Note that London had eight observation stations in operation in 1920–1921.

It is unfortunate that some of the stations from which figures were available for the previous reports have ceased to carry on the observations, and that Oldham, Bolton, Manchester, Leicester and York have dropped out of the list. The figures for those that remain, however, and especially the returns from Glasgow and London, are of great value for comparative purposes, and enable us to judge what progress is being made in reducing the soot and dust fall in the towns still included in the table.

Rochdale again occupied the unenviable position in 1920–21 of being the dirtiest town of those in which observations were made, although some improvement is recorded as compared with the worst period of the war, namely, 1917–18. Bolton, Oldham and Rochdale, the three Lancashire cotton towns, in fact, stand in a class apart as regards the character and amount of their atmospheric pollution; and the two former are separated by a wide gap from the next group of manufacturing towns, with total deposits lying between 400 and 700 tons per square mile per annum. The figures for Newcastle-on-Tyne show an improvement as compared with the worst record of 713 tons for 1916–17; but the 1920–21 total of 534 is not quite so good as that of 477, for the first year of observations in that city. Liverpool, with 528 tons, compares favourably with 574 and 588 tons for the earlier years; and the St. Helens total of 380 tons, compared with 627 tons in 1917–18, seems to call for some explanation other than that given above.

The Glasgow and London figures, however, are the most significant, for covering as they do the records from a very large number of observation stations, they are more reliable than the others, and may be taken as a correct criterion of the improvement of the atmosphere which is taking place in both cities. The Glasgow figures, showing a fall to 322 tons from a maximum of 438 tons in 1917–18; and the London figure of 315 tons from a maximum of 451 tons in 1915–16, are very encouraging to smoke reformers, since they indicate that when real interest is aroused, as in London and Glasgow, in the subject of smoke abatement, the atmosphere of our towns and cities may be made to approach that of the countryside in freedom from solid impurity.

The figures for York, Rothamsted and Malvern, which occupy the last portion of the table, mark the lower limit to which we may expect to reduce solid atmospheric pollution, when smokeless fuel is used generally for domestic and industrial purposes in all our cities and towns.

In Tables III. and IV. of the report, the total deposits for the six summer and six winter months are given separately, and are compared with the figures for the preceding year. In order to assist in the comparison, two analytical statements have been prepared to show which towns show a decrease and which an increase in the total pollution during the two periods of six months, and these analytical tabular statements, which are of great interest, are reproduced in condensed form in Tables IV. and V.

Commenting on the position as regards the increased pollution of the atmosphere during the summer months of 1920–21, the Committee states that:—

"The figures opposite each station indicate the percentage ratio of the deposit in 1920 to that in 1919. For example, the figure opposite Meteorological Office, London—that is, 207 per cent.—indicates that the deposit was 2.07 times the deposit in the previous summer.

"The right-hand column of Table IV. gives a list of the stations showing a diminished deposit in the summer of 1920, as compared with the previous summer.

"A consideration of this Table IV. shows that the number of stations having an increased deposit in 1920 was greater than the number having a smaller

TABLE IV.—*Total Solids Deposited, Expressed as Percentage of Deposit in Same Months of Previous Year.—Summer Months, 1920.*

Increased.	Per cent.	Diminished.	Per cent.
London—		London—	
Meteorological Office	207	Finsbury Park	94
Victoria Park	175	Ravenscourt Park	55
Golden-lane	110	Southwark Park	59
St. Helens	142	Glasgow—	
Southport—		Richmond Park	94
Hesketh Park	120	Ruchill Park	99
Woodvale Moss	117	Victoria Park	99
Glasgow—		Malvern	51
Alexandra Park	113		
Bellahouston Park	122		
Blythswood-square	149		
Botanic Gardens	124		
Queen's Park	111		
Tolcross Park	109		
Rothamsted	111		

TABLE V.—*Total Solids Deposited, Expressed as Percentage of Deposit in Same Months of Previous Year.—Winter Months, 1920–1921.*

Increased.	Per cent.	Diminished.	Per cent.
London—		London—	
Southwark Park	107	Meteorological Office	83
Newcastle-on-Tyne	103	Finsbury Park	52
Glasgow—		Ravenscourt Park	92
Blythswood-square	105	Victoria Park	69
Richmond Park	104	Wandsworth Common	93
		Golden-lane	92
		St. Helens	58
		Southport—	
		Hesketh Park	73
		Woodvale Moss	87
		Rochdale	56
		Rothamsted	98
		Kingston-upon-Hull	93
		Glasgow—	
		Alexandra Park	63
		Bellahouston Park	94
		Botanic Gardens	85
		Queen's Park	96
		Ruchill Park	91
		Tolcross Park	90
		Victoria Park	89

deposit. Referring now to Table V., in which a comparison of the winter months of 1920–21 is made with the previous winter, we note that out of a total of twenty-three stations the deposit in the winter of 1920–21 was less than in the winter of 1919–20 in nineteen cases. The deposit was greater in four, but the increase in those four stations did not in any case exceed 7 per cent.

"It is thus curious to note that there was a fairly general increase in the summer deposits and a reduction in the winter deposits of the year 1920–21.

"A great increase is shown in the Meteorological Office gauge during the summer months, and this is not due to an increase in any particular element of pollution, but to an increase in practically all. Although the total solids in the summer of 1920 were 207 per cent. of those in the summer of 1919, it is of interest to observe that the rainfall in the summer of 1920, although slightly increased, was only 122 per cent. of that for the previous summer."

The variations between the summer and winter months are no doubt partly attributable to the dust from street traffic in the dry summer months of the year; and it is the winter returns which are the more important from the smoke-abatement point of view. It is satisfactory to note therefore that the winter returns from the majority of stations showed a decline as compared with those of the year before, and that only one station in London and two in Glasgow showed a slight increase in their deposits during the winter months of 1920–21.

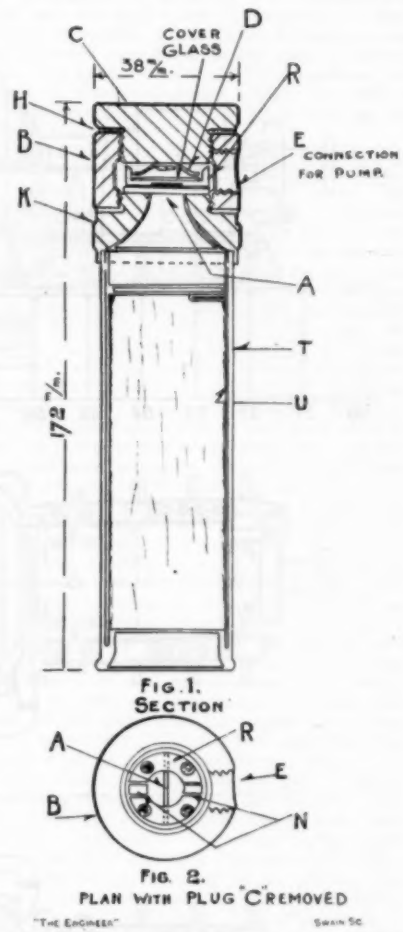
MEASUREMENT AND RECORDS OF THE SUSPENDED IMPURITIES OF THE AIR.

A paper upon the "Suspended Impurity in the Air," by Dr. J. C. Owens, was contributed by Sir Napier Shaw to the Royal Society in November last year, and is reprinted in Vol. 101 of that Society's "Transactions." This paper contains a description of another instrument which has been devised by Dr. Owens for the measurement of suspended atmospheric pollution, and since the results obtained in preliminary observations with this new dust recorder are of far-reaching significance and importance, a description of it is appended to this article.

The new instrument is known as the jet apparatus for dust examination, and depends for its action upon the fact that when air which contains dust and a sufficient amount of water in the form of vapour has its pressure suddenly reduced, there is a fall of temperature and a condensation of moisture upon the dust. If the dust particles thus enveloped in moisture be brought into contact with a glass surface and the moisture be then evaporated, the dust will adhere and can be examined microscopically. In the instrument this result is brought about by causing a very fine ribbon-shaped jet of air to strike a microscope cover glass, placed about 1 mm. from the opening forming the jet. The air before entering the jet passes through a damping chamber, and the velocity in the jet is such that the fall of pressure results in bringing about a condensation of moisture on the dust at the moment of striking the cover glass. The air is then deflected, and as the velocity falls off the pressure and temperature rise, the water is evaporated, and the dust is left behind as a deposit on the glass.

Figs. 1 and 2 show that the apparatus consists of a brass sleeve B, open at the top and bottom, and screwed internally for the reception of a plug K. The latter is perforated by a central hole, for admitting the air to a narrow slot formed diametrically across the hole by means of two semi-circular metallic plates, held in position by a ring R, attached to the plug K. The upper surface of this ring is recessed to form a bed for a microscope cover glass, and a central cell, 1 cm. in diameter and 1 mm. deep, is thus formed under this cover glass. In the floor of this cell is the narrow slot for admitting air.

Into the upper opening of the sleeve B screws a solid plug C, on the inner face of which is fixed a three-claw spring, by which the cover glass is held gently down upon its bed when the plug is screwed home. The washer H makes an air-tight joint between the plug C and the sleeve B. Inside the sleeve B and



THE OWENS JET APPARATUS FOR DUST EXAMINATION

surrounding the cover glass is an annular recess which communicates with a connection E for attachment to a 50 cc. air pump. Channels N are formed on the upper surface of the ring R under the cover glass—shown in Fig. 2—so that when the air is drawn from the space between the plugs C and K by the air pump, a jet of air enters the slot A, impinges upon the cover glass and escapes to the annular space in B, and so to the pump E.

A damping chamber T, which is detachable from the plug K by unscrewing, is provided. This chamber is lined with blotting paper, which is wetted before the instrument is used.

To take a record the pump is fixed to the connection E, and before the plug C is removed three or four strokes of the pump are made to fill the damping chamber with air. The plug C is now removed, and a carefully cleaned cover glass is placed in position upon the ring R, after which the plug C is replaced rapidly and screwed home. The pump is then operated smartly so as to draw one or more volumes of air through the jet, allowing an interval of about one-quarter of a minute between each pump stroke, to permit the air to absorb moisture. The plug C is finally removed, and the cover glass is dropped out on to the hand and mounted on a microscope slip.

The record consists of a linear deposit of dust, and a count of the number of particles in this way may be made by the aid of the eyepiece micrometer, a strip being counted completely across the record

at one or two places, and an average taken. This figure multiplied into a factor, depending upon the magnification used, will give the number of dust particles on the record.

The practical applications of this microscopical method of determining the amount and character of the suspended impurity of the air are many and varied, and only one can be named here. The chief source of suspended atmospheric impurity in this country is the burning of smoky fuel. The seasonal variation is very well marked, the quantity of impurity falling off to a minimum in the summer and rising to a maximum in the winter, when the domestic fires are in full operation. There is a similar relation in the hourly variation, the only period comparatively free from smoke pollution being the small hours of the morning when fires are out. The distance to which smoke impurities travel from their source is not known; but Dr. Owens and other observers have noticed that when the meteorological conditions are suitable, it was usual to find a bluish haze overlying the whole country. By aid of the filter described previously, this haze was found to be composed of solid particles, which gave a distinct discoloured record on the white filter paper. It is a matter of conjecture where these particles have come from, but Dr. Owens hazards the statement that they are often derived from the smoke of continental fires. From observations made by him on the East Coast last August, in fact, it appears highly probable that the great industrial activity of Germany, when the wind conditions are favourable, is responsible for a fair proportion of the suspended impurity in the air over this country.

The method of making the observations and the data upon which this statement is based, will be found in the volume of the "Transactions" of the Royal Society already referred to.

Foettinger Transformers on a Liner

No. I.

IN our issue of June 23rd we gave some account of the new Canadian-Pacific liner, the Empress of Australia, and briefly referred to her special machinery. Through the courtesy of her owners, Canadian-Pacific Steamships, Limited, and her builders, the Vulcan Works of Hamburg and Stettin, we are now enabled to give further particulars of her machinery installation and her performance, and in the present article we propose to deal more especially with the Föttinger transformers and the manœuvring and emergency gear.

GENERAL ARRANGEMENT OF MACHINERY.

The turbine machinery is divided into two units, as will be seen from Fig. 1, each unit consisting of a high-speed turbine driving a Föttinger hydraulic transformer, which transmits the power developed by the turbine to the propeller shaft at a reduced speed. In the installation under consideration the speed of the turbine under normal running conditions is about 800 revolutions per minute, and the propeller shaft turns at a speed of 160 revolutions per minute, which corresponds to a reduction of about 5 : 1. Each turbine is rated at approximately 7250 shaft horse-power, but this is perhaps a conservative estimate, for with the oil-fired boilers slightly higher outputs have been maintained without difficulty, while the vessel has been shown to be satisfactory as regards speed. We hope to refer to her actual performances later.

The Föttinger transformer has already been described in our columns*, and both the earlier and later forms of its construction have been dealt with. A section through the transformer, along with details of the transformer pump, and the reversing, manœuvring and emergency gears are given in our Supplement to-day. The manner in which the transformer performs its manœuvring function may be briefly summed up as follows:—The transformer consists essentially of an ahead and an astern "circuit," each of which is furnished with a primary wheel, guide blades and a secondary wheel, and according to the direction of the ship, one or other of these circuits is filled with water by the transformer pump, the water inlet and outlet being controlled by piston valves operated by a steam reversing engine. Referring to Fig. 1, it will be noted that a tank is built into the framing of the ship beneath the transformer, which serves to receive the water transferred during the operation of reversing, and also to accommodate any leakage water from the transformer glands. The transformer pumps, which are of the vertical type, are also placed over the tank and draw their supplies from it. In passing, it may be remarked that the turbine and transformer are separate, with an interposed thrust bearing, and they are situated in different engine-rooms separated by a water-tight bulkhead. The reason of this arrangement is that the ship was designed shortly after the Titanic disaster, and special regulations were enforced regarding the water-tight division of the hull. In nearly all other Föttinger installations the transformer has been built close up to the turbine, so that the prime mover and transformer together form a common unit, thus securing a close and compact grouping of the machinery. In the installation we are describing the turbine and transformer are tied together in a longitudinal direction, and are fixed to the framing of the ship in such a way that part of the thrust received by the transformer from the propeller and transmitted by it to the turbine is taken by the hull. Thrust bearings are, of course, fitted, and their design and arrangement will be referred to later. The first transformer for this ship was completed and tested as early as 1913 at the Hamburg works of the Vulcan Company,

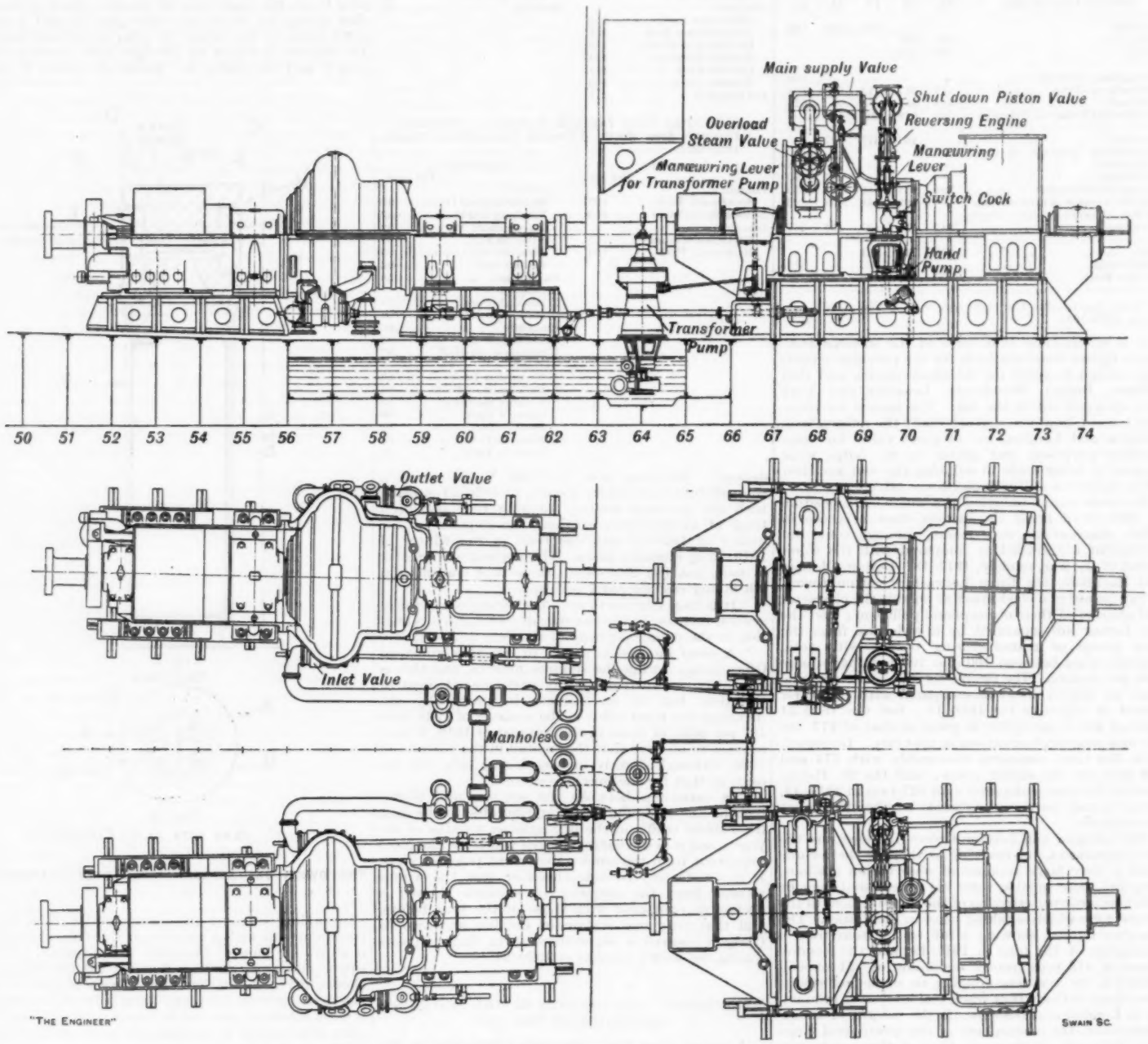


FIG. 1—THE PROPELLING MACHINERY OF THE CANADIAN-PACIFIC LINER EMPRESS OF AUSTRALIA

* See THE ENGINEER, March 31st, 1911, and September 11th, 1914.

and while the design in the main is unchanged, certain modifications have been made in the method of fastening the transformer rotors to the shafts, and in the design of the stuffing-boxes, outlet channels, and cooling arrangements. At the points where the rotors project through the casing and through each other, and where the primary and secondary wheels project through each other, the peripheral surfaces are provided with brass rubbing rings, while the packing ring for the ahead primary wheel is lined with white metal.

THE MANŒUVRING GEAR.

The general arrangement of the manœuvring gear is shown in Fig. 1 and its details in the Supplement. In the present improved design the operating of the necessary valves, both on the turbine and transformer, is carried out by means of a reversing engine, which also controls the transformer pumps which supply the water to the transformer circuits.

The steam circuit of each turbine contains an emergency stop valve which in certain circumstances is operated by the emergency gear and a shut-down piston valve which is moved by the reversing engine, while the main steam supply valve and the overload nozzle valves may be operated by hand. Manœuvring is effected by (1) the main steam supply valve, which regulates the supply of steam to the turbine; (2) the reversing engine, which controls the piston valves on the transformer, admitting water to the ahead

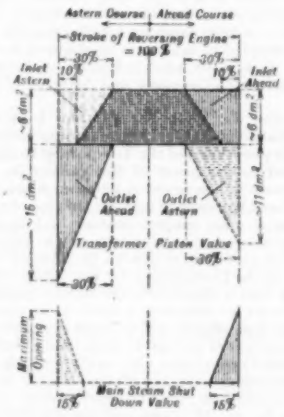


FIG. 2

or astern circuits as required. The reversing valves are positively connected to the shut-down piston valve, so that the supply of steam is completely cut off from the turbine before the reversing of the transformer begins. This is necessary because when emptying the ahead circuit of the transformer, which is no longer required for the astern course, the primary rotor is only partly loaded, and if the steam were not shut off the turbine would race. The laps of the shut-down valve and those of the reversing valves of the transformer are so arranged that when the propeller shaft is being reversed in direction the following operations take place. The steam is at first shut off, the ahead circuit of the transformer is then emptied, and the astern circuit filled by the transformer pump. Then, when steam is again admitted to the turbine, the propeller shaft rotates in the opposite direction. The reversing engine is so designed that the first part of its stroke is passed through quickly and the second part more slowly, giving sufficient time between the closing of the steam valve and its reopening for the filling up of that circuit of the transformer which is coming into action. The action of the reversing engine valve, the transformer piston valve, and the main steam shut-down valve is depicted diagrammatically in Fig. 2. A hand pump is also provided for hand reversing.

THE TRANSFORMER PUMPS.

The transformer pump, as will be seen from the section reproduced, consists of a vertical type steam turbine carrying three Curtis type wheels, the steam inlet being governed by a nozzle valve giving steam to the required nozzles. As previously mentioned, the two transformer pumps and the reserve pump are placed over the transformer tank, and the pumps draw from this tank and deliver to the transformer circuits. In addition to the transformer pump proper, there is on each pump an overflow pump which deals with the water flowing from the tank overflow and delivers any surplus water either to the feed tanks or overboard. The steam for the transformer pumps passes through the steam supply valve, the strainer, and the emergency and regulating valves, and the supply valve is always completely open when the pump is working.

The emergency stop valve is actuated by a centrifugal governor on the top of the pump shaft, which automatically comes into action when a speed of 4500 revolutions per minute is reached, and means are provided for testing this governor. The speed of the transformer pump, and, consequently, the water pressure in the transformer circuits, may be regulated by means of a hand lever, which, by means of a regulating valve, opens two or more nozzles according to its position. During manœuvring, and when the ship is going astern, the transformer pump is automatically brought up to a speed of 3500 revolutions per minute by the reversing engine. This gear is so arranged that when the reversing engine passes from the ahead position to the end of the astern position the regulating valve is fully opened and maintained open until the engine returns to the end ahead position again. If no further manœuvring is expected, the regulating valve can be operated by the manœuvring hand lever until the speed of the transformer pump is reduced so that it only supplies the leakage make-up water required by the transformer circuit in operation. The transformer pumps are so interconnected that each pump can deliver water to either transformer, and the reserve pump can take the place of either of the two main pumps. In the normal way fresh water alone is used in the transformer circuits, but in case of emergency salt water may be used. The relation of the speed of the main turbines and the pressure in the transformer circuit is shown in the following table:—

Speed of main turbine, r.p.m.	Pressure in inlet chamber of transformer. Ahead.	Astern.
840	60 lb. per sq. in.	90 lb. per sq. in.
800	52 lb. per sq. in.	82 lb. per sq. in.
470	37 lb. per sq. in.	42 lb. per sq. in.

The actual operation of reversing is carried out very quickly and with certainty, all pressures being shown on the gauges at the control stations. The general time of reversing was between 20 sec. to 25 sec., and we learn that with a modified form of oil-distributing valve on the reversing engine the time was further reduced to 15 sec., but it was not thought necessary to reduce the first-named figure, which proved fully satisfactory for the manœuvring of the ship.

THE EMERGENCY GEAR.

Fig. 3 shows the general arrangement of the emergency stop gear, which is also illustrated in detail in the drawing reproduced in the Supplement. The

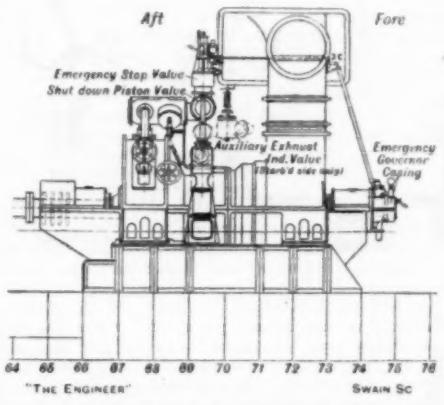


FIG. 3—ARRANGEMENT OF EMERGENCY STOP GEAR

gear is grouped at the forward end of the turbine, and its function is to shut off the steam from the main turbine in the following cases:—(1) When the pressure of the transformer pump fails and, owing to the partial draining of the transformer circuit, the turbine is released from its load; (2) when the turbine exceeds its permitted maximum speed and causes the emergency governor to operate. For this purpose the following arrangement is employed. A distributing piston valve moving in a steam cylinder *c*—see Supplement—is attached at its upper end to a floating lever *d*, which is connected at one end to a water piston actuated by the pressure in the discharge pipe of the transformer pump, while the other end *l* is connected through a bell-crank lever and rod to the emergency governor of the turbine. As long as neither of the two cases above mentioned occur—and it is not possible for them to occur both together—the piston valve is held by the lever *d* in such a position as corresponds with an open emergency valve. Should, however, the water pressure in the transformer circuit fail and fall below 30 lb. per square inch, the lever *d* moves round the fulcrum *l*, and in doing so changes the distribution of steam to the cylinder *a*, and the steam now acting on the upper surface of the piston *b* instead of the lower surface as before closes down the emergency stop valve. Similarly, when the speed of the main turbine exceeds 950 revolutions per minute and the pendulum *g* of the emergency governor comes into action knocking away the catch *h* which holds the rod *l* in position, a similar movement takes place, and the emergency stop valve is closed. The emergency stop gear may also be operated by hand by an emergency hand lever situated at the extreme end of the turbine as well as by the governor, and the emergency stop valve may be again opened by lifting the lever *t*, which is provided for that purpose at the forward end of the turbine.

Thus means are provided for the protection of the main turbine and the transformer pumps, and the emergency stop gear may be tested by hand before starting up the turbine.

Electric Smelting of Pig Iron in Sweden.

IN the year 1905 the Faraday Society discussed a paper by Harbord on "Recent Developments in Electric Smelting in Connection with Iron and Steel." The question of smelting ordinary pig iron electrically seemed then, in the words of the late Mr. Bertram Blount, "So remote as to be outside the region of practical politics." Since then, the war has caused such a change in the general state of affairs that it seems possible that within a not very distant future electric smelting by the aid of water power will be the only economical way of getting pig iron. Coke smelting means the gradual destruction of natural wealth in the form of coal seams, whereas hydro-electric smelting leaves that capital untouched. As a matter of fact, the first method means ever-increasing cost of production, and the other the reverse as the initial cost of dams, &c., is written off. This fact is realised to the full in countries rich in water power, and during the war, when coal was difficult to get, the United States, Canada, Sweden and Norway, &c., erected a number of hydro-electric installations for metallurgical purposes. In America, electric brass melting even became an accomplished fact, in spite of the comparatively speaking low temperatures necessary and the high value of the product. Production of high-quality basic Martin low-carbon iron was also initiated over there on the basis of electric pig iron. As a matter of fact, the "Transactions" of the American Electro-Chemical Society for 1920 is mainly filled with papers on subjects bearing on problems of this kind.

Reverting to Europe, we find that Sweden produced in 1918 some 76,000 tons of pig iron in eleven electric "blast" furnaces of different sizes. The quantity is, of course, not great, but the experience gained is such as to make expansion an easy matter. A type of furnace has been evolved which unites some of the advantages of the charcoal blast-furnaces with those of the electric arc-resistance furnace. We give below an illustration of an actual unit, constructed by Messrs. Lindblad, Stalhane and Grönvall. As will be seen, the furnace is a combination of a blast-furnace shaft with an electric hearth, the whole working closed so as to allow circulation of the gases. The charging is done at the top through a hole provided with the usual closing cone, and, once started, the smelting proceeds in the ordinary way. At the top, the gases enter a system of pipes provided with a release valve, and are continuously circulated over the hearth and through the shaft by means of a blower, as shown in Figs. 3 and 4. There are four or six electrodes arranged through the roof of the hearth, as shown in Fig. 2. This arched roof is made rather thin to diminish loss by conduction between the electrodes. The capacity of the furnace in question is 23 tons of pig iron in twenty-four hours, and it has a height of 13.7 m. overall, and an inner volume of 38 m³. Hence it may be said to be a transition size between experiment and manufacture on a really large scale. In as far as novelties are concerned, the circulation of the gases and the regulation of the energy are noteworthy. The latter is performed by cutting out windings on the high-tension side of the transformers, which are designed for two or three phases, working independently of one another. By this arrangement the perpetual moving up and down of the electrodes is avoided. The energy consumption is approximately 1500 kilowatts delivered at 80 volts. One metric ton of pig required in an official test 1749 kilowatt-hours against the theoretical 1301, thus showing an energy efficiency of 74.39 per cent.

It is difficult to draw comparison between the results of Swedish smelting and those obtained elsewhere, as the former are made with ores of absolutely exceptional purity. The bulk ore used in the above efficiency test was "Tuollavara" magnetic, containing metallic iron, 67.28 per cent.; phosphorus, 0.006 per cent.; sulphur, 0.004 per cent. Ores almost free from sulphur are not unusual in Sweden, and as much as 0.1 per cent. is rare. This fact in itself is of great importance when electric smelting is adopted. For subsequent acid-steel making, the low percentage of phosphorus in the ores from Central Sweden is also a great advantage. Furthermore, electric pig iron smelting has been found to remove phosphorus better than the ordinary process, although the de-sulphurisation is worse. The real difficulty in electric pig iron smelting in Sweden seems to be the regulation of the sulphur, which varies with the temperature of the hearth, and becomes normal very slowly—according to trial, just about five days after the start. The cause is to be found in the necessity for starting with coke as a reducing agent and gradually replacing it with charcoal. The consumption of the latter commodity is only 35 to 45 per cent. as compared with that in the blast-furnace. This is, of course, a very great consideration in Sweden, where economical forestry is of great national importance.

If we now turn to the question of costs, the first item is that of power. We have seen that 1 ton of pig iron requires 1749 kilowatt-hours. Taking a year of 300 days, a kilowatt-year means 7200 kilowatt-hours, thus corresponding to 4 tons of pig iron. The actual cost per kilowatt-year varies, of course, very greatly in different places, and with the always fluctuating rate of interest, &c., but one may safely

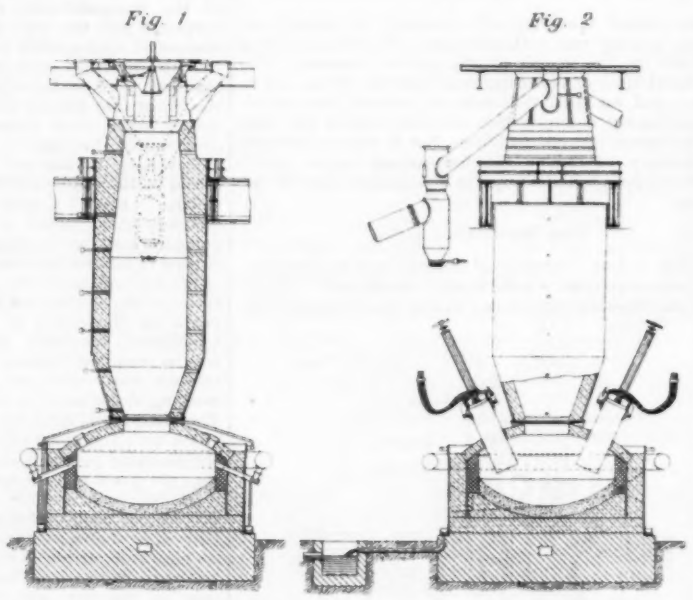
assume the figure of £2 for the modern very large units erected in Sweden. Hence the cost of power per ton of pig is something like 10s. The consumption of electrode carbon has been found to amount to less than 5 kilos. per ton of iron. Against these costs must be set a saving of more than half a ton of charcoal, which, of course, means that electric smelting is by far the cheaper process. With the coke prices now ruling, the same result holds good. The financial results of the pioneer undertakings in Sweden have not been very brilliant up till now, but it must be remembered that the works are saddled with a lot of dead capital representing years of non-paying experiments. Far-seeing men in that country are at present holding back the building of ordinary blast-furnaces partly by reason of the general stagnation in the first place, but also in view of the fact that should coke prices remain permanently above a certain level, then electric smelting will be the one thing to adopt for an eventual expansion of the Swedish iron trade. It is not likely, however, that smelting of ordinary Swedish charcoal iron will be abandoned, as up to now its steel-making qualities have not been equalled by the products of any other process. Why this should be so has never been scientifically proved, but it remains a fact, and Swedish makers are not likely to abandon the old method in a hurry.

The expansion of the manufacture of electric pig iron is closely connected with the electrification of the railways, which involves the harnessing of a number of waterfalls by the State. The progress in that line is naturally slow on account of the discrepancy between the size of the population and that of the country. In surface, Sweden is greater than Great Britain and Ireland together, and the population is just about 5½ millions. The country lies between 55 deg. 20 min. N. and 69 deg. 4 min. N., thus extending 914 miles in the northerly direction. On account of the peculiar configuration of the land, the water power is distributed with a regularity seen nowhere else. The bulk of the country, which lies north of Stockholm, is for some 600 miles traversed by parallel rivers at fairly even distances apart, running north-west to south-east into the Gulf of Bothnia. Some eight of these rivers are very large with a fall of, on the average, more than 4000ft. in less than 200 miles as the crow flies. They expand into large lakes on the higher levels, and form waterfalls and rapids all over the place. The total horse-power available has been estimated at ten millions. In some parts of the north there are bifurcations between the rivers, and the whole system of waterways is adapted by nature for increasing the existing reservoirs by dam building. Proper regulation and utilisation of this water power has been under contemplation for years, and a good beginning has been made. The forest extends all through the district up to moderate altitudes, and almost inexhaustible resources of iron ore will be available everywhere when the central railway is opened for traffic. Hence a more ideal place for establishing electric smelting of iron could hardly be imagined, especially as the climate is not so severe as might be expected. The gradual harnessing of the waterfalls for electrifying the railways will undoubtedly leave excess power for establishing works, which, in their turn, will supply goods for transit. This combination of circumstances will simply force the electric pig iron smelting into the position of a first consideration, as it has already done in several places.

From an English point of view, the gradual migration of the iron smelting to the waterfalls, from which raw materials for engineering may be got, means an increased possibility for using coals for more profitable purposes. As a matter of fact, Canada must also develop her iron industry on the same lines as Sweden, though somewhat modified on account of the ores being less rich. The satisfactory development of electric pig iron smelting is, according to the present state of the art, closely associated with the richness of the ores, and that is where Sweden occupies a unique position. There are some 1158 million tons of ore in sight, averaging 740 million tons of metallic iron contents. This means an average of 64 per cent., or nearly double that found anywhere else in Europe in the ores. Great Britain, for instance, has 1300 million tons of ore in sight, containing some 455 million tons of metallic iron. The figures are quoted from "The Iron Ore Resources of the World," edited by the Executive Committee of the eleventh International Geologist Congress in Stockholm, 1910. (This report was printed in English.) Newfoundland and the United States have, next to Sweden, the richest ores, averaging round about 50 per cent. metallic iron. These ores are—some of them at least—suitable for electric smelting even at present, but naturally any large amount of slag is a great drawback in the electric furnace. In the Swedish practice it runs about 15 per cent. of the iron produced. Everything considered, the probabilities point to that particular industry making the first rapid progress in Sweden, and to its gradual migration across the Atlantic.

We are informed that a 50,000 horse-power plant is at present under contemplation by a private company. Should it materialise in a year or two, then something of a practical nature will have been done, for an output of over 100,000 tons of pig iron would be ensured, and the total Swedish production of that material never exceeds 800,000 tons per annum.

The pyro-electric manufacture of tool steel in Sweden has not developed into anything considerable, reaching just 7300 tons in 1917, whereas the output of open-hearth steel touched 500,000 tons during the same year. It remains to be seen whether the increased price of fuel will give a stimulus to the manufacture of electro-steel, which has all along been cheaper than crucible steel. Here in England electro-steel has been manufactured to a greater extent than in Sweden, in spite of the higher cost of power, the cause being that English Martin steel and Bessemer steel, unless made from Swedish charcoal pig iron, cannot be used as tool steel. Of late there have been indications pointing to the probability of the latter method being adopted, basing the manufacture of quality open-hearth steel on imported Swedish pig iron just as the crucible steel manufacture was and partly is based on imported Swedish bar iron.



SWEDISH ELECTRIC FURNACE FOR SMELTING IRON ORE

BOLIVIAN RAILWAY PROJECTS.

A PROPOSAL has been made to the Bolivian Government for the construction and exploitation of a railway from Puerto Suarez, on the eastern frontier of the republic, to some point, yet to be decided upon, situated on the Beni River, passing through the rich agricultural province of Chiquitos and the no less productive territory of Santa Cruz. In all probability the terminus selected will be at a spot marking the confluence of the rivers Grande and Piray. The estimated cost of the work is £4000 per kilometre. The concessionaires have asked the Government to guarantee a return of 5 per cent. upon the outlay, not alone upon the line construction, but upon the erection of suitable buildings at Puerto Suarez. The contractors—the Belgian South American Company, of Brussels, represented at La Paz by the manager of the Matto Grosso de Bolivia—offer a deposit of £40,000 sterling as guarantee for the carrying out of the whole work within a period of five years.

In the meanwhile, a second offer is being considered by the Bolivian Government for the construction of a railway from Santa Cruz to Rio Grande. The offer emanates from the Madeira-Mamoré Railway Company, in which a large amount of British capital is invested, and is designed as a substitution for a contract entered into in 1911 for the building of a railway from the left bank of the Mamoré River through Guayaramerin to the city of Riberalta, also on the Béni River. The concessionaires have submitted three alternative routes:—(1) Construction of a wide highway, suitable for motor traffic from Santa Cruz to Cuatro Ojos, Puerto Velarde, or some other equally suitable point on the Rio Grande, convenient for the loading and unloading of river steamers; (2) construction of a narrow-gauge railway between Santa Cruz and a port on the Rio Grande, bringing into the scheme the construction of a new highway and improving that already in existence; (3) the construction of an aerial cableway between Santa Cruz and the proposed river port, making use of the present route, or selecting a new one.

Peace Treaty Patents.

THE provisions of the Peace Treaty which refer to Letters Patent for inventions contain certain clauses under which the practice is not yet fully settled. A decision of the Comptroller of Patents therefore, which was recently given and has now been published in the reports of Patent cases, will be helpful to inventors as showing the way the Patent Office deals with what is known as Article 308 of the Peace Treaty with Germany and Article 1 of the Berne agreement.

An application was made for a patent by a citizen of the United States in July, 1920, claiming priority from 1913 under the provisions of the Temporary Rules. Objection was raised to the grant of this patent by a British company because in the interval between filing the application abroad and the date of filing in this country a patent application on similar subject matter had been lodged. The company alleged that this was not a case in which the earlier date could or ought to be allowed under the powers given to the Comptroller by the Temporary Rules, and that they had a direct interest in the question as to what date should be allowed, inasmuch as their British patent, which was dated 1918, would undoubtedly be affected by the grant of the earlier date to the United States applicant. The Comptroller ultimately held that in view of the understanding with the United States of America, the applicant should be given the earlier date, but that in his discretion he would insert specific conditions in the patent for the protection of persons who were *bonâ fide* in possession of the invention prior to the date of application in this country.

Certain passages in the Comptroller-General's decision are of interest, particularly in connection with his reading of the Peace Treaty. He points out, for example, that with reference to Article 308, which became the basis of the article inserted in all the other treaties, and also of Article 1 in the Berne agreement, this Treaty is one of the very few instances in which the sections of a Treaty have themselves been given the full force and effect of law. In this country treaties as a rule have been considered merely as laying down the general principles upon which subsequent legislation should be based. This course has its advantages, because it is difficult in framing the clauses of a Treaty to draw them with the accuracy of wording necessary in the case of an Act which has to be judicially interpreted in the Courts. He therefore reads the article in question to indicate only generally the kind of protection which should be accorded, and that the interpretation of its language in this country should have regard to the ordinary law of the country as well as to customs and ordinary commercial procedure. The first clause of the article provides for the extension of time, being given in case of Convention rights of priority.

The second clause is as follows:—"Nevertheless, such extension shall in no way affect the right of any of the high contracting parties or of any person who before the coming into force of the present Treaty was *bonâ fide* in possession of any rights of industrial property conflicting with rights applied for by another who claims rights of priority in respect of them, to exercise such rights by itself or himself personally, or by such agents or licensees as derived their rights from it or him before the coming into force of the present Treaty; and such persons shall not be amenable to any action or other process of law in respect of infringement."

In the opinion of the Comptroller on which he based his judgment the only reasonable meaning which could be given to Article 308 in the light of English law and practice is as follows:—

Extensions of time for claiming rights of priority under the convention must be granted as a matter of right under the first clause. Any patent so granted cannot be invalidated by the existence of a patent subsequent in date. Clause 2 cannot, therefore, be considered as a clause which negatives the right to claim extensions under Clause 1 if patent rights are already in existence. The rights referred to in Clause 2 include an invention whether protected by patent or otherwise, but must be construed as conferring only the personal right on the individual in whose possession the invention or the like lies to make, use and vend the invention without any interference from the patentee. The same rights may be enjoyed also by any agents or licensees who derived independent rights to manufacture, use, or vend the invention from such individual before the date of the patent application.

In his judgment the Comptroller at some length also deals with the rights of agents and licensees, the bearing of the Nolan Act, which is the United States Act dealing with delayed patent applications due to the war, conditions that ought to be inserted in a grant under the circumstances considered, and the rights in the complete discretion of the Comptroller of imposing conditions.

A Seven-Day Journal.

Airship Wrecks.

A REMARKABLE accident happened to an Italian airship on Saturday, the 1st inst., when over the Gulf of Taranto. The dirigible had made a trip across the Gulf, from Taranto, and was returning when it encountered heavy weather. The wires by means of which the car was attached to the gas bag gave way, and the car fell into the sea from a height of 600ft., while the balloon disappeared aloft. Boats put out from the shore and were in time to rescue the whole crew of 20, together with Admiral Salazar, some of whom were, however, rather seriously injured. Another Italian airship, the P.V., which was attached to the local aviation school at Rome, was destroyed in the gale without harm to the crew, while a spherical balloon coming from Paris fell into the sea near Mariakerke, but the pilot and his passenger were able to swim ashore.

Factory Illumination.

THE third report of the Home Office Committee on lighting in factories and workshops, which has just been issued, states that the Committee "cannot at present recommend the enforcement of legal minima of illumination for industrial purposes." It is pointed out that the general standard of lighting in progressive factories has risen, and is rising, and that it would be unfortunate if a too rigid requirement, which must be placed low, tended to stereotype existing conditions or even give an excuse for depressing general practice. The Committee recommends that a specification of minimum standards of illumination, as "recommended practice" for different groups of processes be issued. The Committee was impressed by the large number of fatal falls through ships' hatches caused by inadequate lighting, and by several instances, in factories, of accidents in which a shadow cast upon a danger point was a contributory cause.

Steel Structure Collapses.

AN accident of an unusual character in this country occurred at Bilston, near Wolverhampton, on Saturday, the 1st inst., when a steel-framed building in course of construction collapsed, and two men were killed. The building was intended to house a new mill at a steel works, and would have covered an area measuring 300ft. by 80ft. It is not yet quite clear how the failure developed, but it is said that some part gave way, with the result that two sides of the incomplete building collapsed, and some 200 tons of steel work fell to the ground. It is remarkable that the fatalities were not more serious, as from forty to fifty men were employed on the work.

H.M.S. Renown.

THE Renown has just returned home after a very lengthy cruise abroad, and in the ordinary course of events would go into dock for an extensive refit; but, in view of the necessity for economy, the overhauling is to be postponed, and she is, instead, to be placed in reserve. For the same reason the plan of modifying her bulge and strengthening her armour has been set aside. It is, nevertheless, noteworthy that from all accounts her main machinery is little the worse for its experience, which, in view of the rapidity of her construction, speaks well for the Fairfield yard. It may be remembered that the Renown was laid down in January, 1915, and was commissioned some twenty months later, and that while she was designed for a speed of 30 knots at 110,000 shaft horse-power, she actually did 32.68 knots on 126,300 horse-power when loaded to the normal water line.

New African Railway.

THE opening of the Trans-Zambezia Railway, which was effected without any formal ceremony on July 1st, marks an important stage in the development of Nyasaland, the British Protectorate which is cut off from the Indian Ocean by Portuguese East Africa. Nyasaland has for some years possessed a railway which connects Blantyre, the capital, with Chindi, on the Zambesi, and which is to be extended, by means of a branch at Luchenza, to Fort Johnston, whence water transport is now available on Lake Nyasa for a distance of some 360 miles northward. The drawback to this system of communication has been the difficulty of the river transport between Chindio and Chinde, at the mouth of the Zambesi, and the poor port facilities at Chinde. The new railway overcomes this difficulty by connecting Murassa, on the opposite bank of the Zambesi to Chindio, with the port of Beira. A bridge will probably be built between Murassa and Chindio, but in the interval a ferry is being used to connect the two lengths of line. The new railway is 157 miles long, while the total distance from Beira to Blantyre is 351 miles, and it can be covered in about twenty-six hours, as compared with anything from five days upwards by the river route. Another source of interest in the new railway is the character of the country through which it passes, as there are distinct indications that it covers a large oilfield.

Power in Palestine.

NEWS was received in this country during the week that during the Zionist convention, which has just been held in America, a ready response was made to the call for funds for carrying out the Rutenberg scheme of developing the water-power resources of Palestine, and that over a million dollars had been promised. This sum, however, represents only a small proportion of the proposed ultimate expenditure, as the first part of the scheme will probably cost 5,000,000 dols., while the ultimate development will require, it is expected, twenty times that expenditure. Work on the first stage will probably begin in March, 1923, and involves the construction of a power plant on the Jordan about eight miles below its efflux from Lake Tiberias, and the erection of a transmission line from the power station to Haifa and thence to Jaffa and Jerusalem. The Jewish Colonial Trust, of London, is interested in the scheme.

Glasgow Subway.

THE Glasgow Subway Railway was reopened on Sunday afternoon, the 2nd inst., under a provisional arrangement between the company and the Corporation, pending parliamentary sanction for its acquisition by the city at the price of £385,000, as it had been found that the closing of the subway had caused great inconvenience to the travelling public. At the opening ceremony, Lord Provost Paxton suggested that there was ample room for improving the means of access to the platforms and hinted that escalators should be used, in preference to lifts, to take the place of the staircases. It is noteworthy that the Glasgow subway was preceded in its construction by only one other tube railway, the City and South London, and has been in existence for some thirty years, during which time such vast improvements have been made in electric traction that the cable system, thought to be the best when the Glasgow subway was built, is now quite out of date for such purposes.

R. W. Thomson.

THE centenary of an event which has had a far-reaching effect on mechanical transport was celebrated on June 29th, when a memorial tablet was placed on the house in Stonehaven, Kincardineshire, where R. W. Thomson, the inventor of the pneumatic tire, was born. Thomson was the original inventor, although Dunlop re-invented the tire many years later and reaped a far better reward from the idea. It was originally intended that he should enter the church, but he adopted engineering as his profession, secured a thorough training, and invented the pneumatic tire in very much the same form as it is now made, at the age of twenty-three. At a later time he took out a number of patents for solid rubber tires for heavy vehicles in conjunction with Colonel R. E. Crompton, one of his few remaining contemporaries, who contributed a brief memoir of him to our issue of June 16th last.

Gas Supply in the Potteries.

A NEW step towards the unification of the gas supplies in the Potteries was taken on the last day of June, when the Corporation of Stoke-on-Trent took over the control of the Etruria Gasworks from the British Gaslight Company. The ceremony, which took place at the company's premises at Hanley, marks the beginning of a scheme for consolidating the four undertakings at Burslem, Stoke, Fenton, and Longton in one plant at Etruria, from which the whole of the Potteries district will be supplied with gas. The purchase price of the Etruria works is said to be £345,000, while the Corporation takes over debentures to the extent of £40,000.

London's Water Supply.

A REASSURING report on the state of London's water supplies was given at the meeting of the Metropolitan Water Board by Mr. C. G. Musgrave, the chairman. He pointed out that the accounts, which have been published recently, that suggested a shortage in the supply available for the Metropolis, and which purported to be based on official information, were quite erroneous. The Board, he said, had issued no such notices, and all it had done was to ask consumers to assist it by using no more water than was necessary, and thus postpone the time when it would be necessary to draw on the reservoirs. As a matter of fact, the reservoirs in the Thames Valley were full, and contained 7000 million gallons, while those on the Lea, which have a capacity of 5600 million gallons, were storing 4800 million gallons. At the same time the flow over Teddington weir was 410 million gallons a day, and that over Feildes weir 16 million gallons. The Littleton reservoir will not, of course, be available for some time yet, as its construction was interfered with by the war, but when it is complete it will add another 6500 million gallons to the storage capacity in the Thames Valley. It is noteworthy that although copious rains have fallen since Mr. Musgrave made these statements, it generally requires about a month before the benefit of rainfall is felt at Teddington.

Transatlantic Records.

THE last homeward voyage of the Cunarder Mauretania, which was completed at Southampton on Monday, the 3rd inst., showed a remarkable consistency with her previous voyages, and virtually repeated the record then made. As a matter of fact, the latest passage occupied three minutes less than the last crossing, and in view of the fact that the distance is 3250 miles the similarity in the time is remarkable. Between noon of Thursday and noon of Friday the vessel steamed 610 knots, and her average speed for the whole voyage worked out at 25.29 knots. The world's record for the trip was made by the Mauretania in September of 1909, when she covered 614 knots in one day. The White Star liner Majestic, which arrived at Southampton from New York on the evening of Friday last, also made a good trip. The crossing was made in a very fast run of 5 days 9 hours and 42 minutes, with an average speed throughout of 24¼ knots, more than three hours quicker than her maiden voyage east-bound.

The Ambergate Derailment.

THE report of Major G. L. Hall on the accident which occurred on April 21st at Johnson's Sidings, near Ambergate, on the Midland Railway, puts the blame for the derailment on the insecurity of the 6ft. wing rail near the knuckle of the diamond crossing. He also suggests that the amount of super-elevation given to the left-hand curve would tend, in view of the speed likely to be attained at the spot, to throw an undue proportion of the weight of the train on the left-hand wheels, and thus tend to wear the running edge of the rails just south of the crossing. It will be remembered that the accident involved the derailment of six vehicles, but there were no very serious personal injuries.

Richardsons, Westgarth New Director.

THE seat on the board of Richardsons, Westgarth and Co., Limited, Hartlepool, Middlesbrough, and Sunderland, which has been rendered vacant by the resignation of Captain Walter Brown, R.N., has been accepted by Vice-Admiral Sir George Goodwin, K.C.B., late Chief Engineer of H.M. Navy.

Higher London Buildings.

A DECISION of immediate interest to the big shopkeepers of London, which will also concern the structural engineering trade, was made during the week by the London County Council, and was communicated to the Incorporated Association of Retail Distributors. The decision concerns the height to which buildings may be raised in London, and the new regulation permits a height of 80ft. from the pavement to the ceiling of the topmost floor, as compared with 60ft. to the level of the top floor allowed by the old rules. At the same time the size of any single compartment in the building has been increased to 500,000 cubic feet, with a minimum floor area of 40,000 square feet. The new rules do not, of course, give full scope to the possibilities of steel buildings, but the longer spans which are sure to be adopted in connection with the larger compartments will involve the extended use of steel girders.

War Bonus Reduction.

A JOINT conference was held in Westminster, on Wednesday, the 5th inst., of representatives of the Engineering National Employers' Federation and the Amalgamated Engineering Union, together with a number of kindred unions, at which the proposed reduction in the war bonus was discussed. Sir Allan Smith presided over the conference, which was, of course, a sequel to the recent cessation of the lock-out in the engineering trades. Representatives of the Amalgamated Engineering Union, the National Union of Foundry Workers, the National Federation of General Workers, the Spindle and Fly Makers, the Mule and Ring Makers, and the Grinders' and Glaziers' Union were present, and there were represented, altogether, about a million workers. It was not specifically stated at the meeting what was the extent of the proposed reduction, but it was generally accepted to amount to 16s. 6d. a week, split up into instalments. The men's representatives urged that such a cut, which would leave them with 10s. of the original bonus and would reduce the weekly wage to £2 16s. 8d., was too drastic.

The Royal Show at Cambridge.

No. I.

THE annual exhibition of livestock and implements promoted by the Royal Agricultural Society of England is being held this week at Cambridge. This is the third occasion that the University town has been selected for this event. The first was in 1840 and the second in 1894. In 1840 the numbers of livestock and implements exhibited were 337 and 115 respectively. In 1894 the number of entries in the implement section had grown to 6031, while the livestock numbered 1864. This was a remarkably fine Show, the stands in the implement section numbering 442 and requiring 13,402ft. of shedding. For the present Show the length of shedding is somewhat less than the 1894 total, although the stands are more numerous. The statement of entries prepared by the Society shows that the entries in the livestock department is by far the largest in the history of the undertaking, the total entries of horses, cattle, goats, sheep and pigs amounting to 4200, the cattle and pig exhibits being chiefly responsible for the increase. No special inducements in the shape of monetary awards have been held out this year to exhibitors in the implement section, but there is greater competition than usual for the coveted silver medals which the Royal Agricultural Society awards each year for "new implements" for agricultural and estate purposes. The number of devices entered for the medals this year constitutes a record. They include a very great variety of appliances, from a steam plough to a pig trough. Although there are several noteworthy absentees, the implement section compares very favourably with its predecessors, and this is all the more remarkable when the conditions under which the engineering industry has recently been conducted are taken into consideration. It would no doubt have been much more extensive, too, had not the Society of Motor Manufacturers and Traders placed an embargo upon its members which prevented them from exhibiting vehicles propelled by petrol engines.

As a centre for the Royal Show, Cambridge is a happy selection. In addition to its normal attractions, there are few parts of the country which possess such a diversity of soils. Cambridgeshire farmers have to contend with the heaviest loam and the lightest sand, but they are generally alive to the advantages to be derived from mechanical appliances in reducing the cost of production. It is unfortunate for the makers of implements that the farming industry is at present suffering from depression like many other trades, but this is only temporary, and the conditions under which it is suffering should stimulate farmers in their endeavours to produce their crops as cheaply as possible, and to do this the assistance of the engineer must be called in more than at any previous time. It must not be forgotten that not only can the cost of production be reduced by the adoption of labour-saving appliances, but the work on the farm can be expedited.

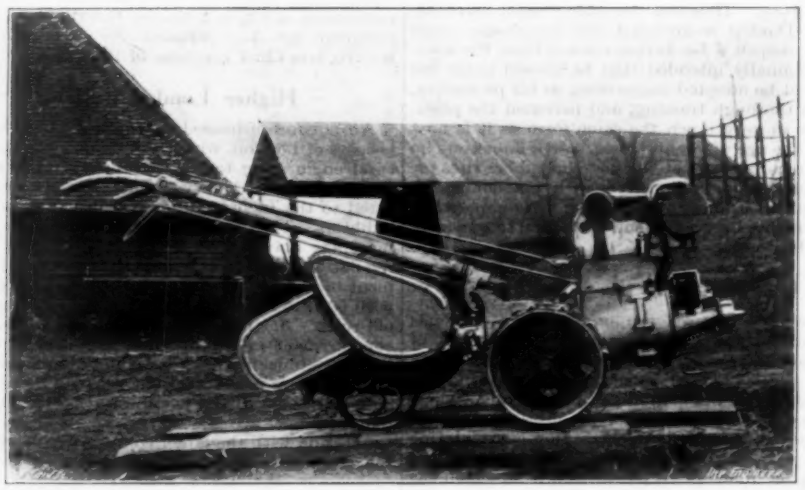


FIG. 1—SIMAR ROTARY SOIL TILLER

In the Simar rotary soil tiller shown in Fig. 1 a petrol engine, in addition to driving the travelling wheel, transmits its power to a rotary sleeve fitted with spring-mounted tines which scrape up the earth. The exhibitors, Piccard Pictet and Co. (London), Limited, Compton-street, Goswell-road, E.C. 1, claim that the rotary principle employed enables the four operations of ploughing, harrowing, rolling and disc harrowing to be done in one. The motive power is supplied by a single-cylinder air-cooled engine with a cylinder 82 mm. bore by 94 mm. stroke, giving a horse-power of 4.17 at 1800 revolutions per minute. The engine is fitted with a high-tension magneto and drives the road wheels through worm gearing with two speed changes. The "miller" or rotary tool is driven direct from the engine by means of a bevel wheel and pinion, and there are independent clutches for the miller and travelling wheels. All the gearing is contained in a casing and runs in oil. The rotary tool is fitted with eight tines and the depth of the work is regulated by means of a shoe controlled by a hand lever with five different positions. The machine weighs only 3¼ cwt. and the wheels are 16in. diameter, the wheel track being adjustable from 15in. to 20in.

The same firm is also exhibiting a larger machine, of which Fig. 2 is a sectional elevation. The body of this machine consists of three units, which are detachable: first, the engine crank case; second, the main gear-box; and third, the miller gear-box. The engine is capable of developing from 6 to 8 horse-power and has forced lubrication of the empty-sump type. For this purpose two oil pumps are provided, one of which delivers the cool oil under pressure to all the working parts of the engine, and the other pumps the oil from the crank case to the tank. In this case the engine is water-cooled on the thermo-syphon system and has high-tension magneto ignition with a cut-out on the steering arm. A conical leather-to-metal clutch transmits power from the engine to the travelling wheels and rotary miller. The drive to the gear shaft which operates the travelling wheels is by means of a steel worm and phosphor-bronze worm wheel, thence by nickel steel gears enclosed and running in oil. The miller is driven by a bevel pinion and crown wheel enclosed in an extension of the gear-box which forms part of the body. The enclosed crown wheel runs in oil and is mounted on the centre of the miller axle, which is parallel to the axle of the driving wheels. The miller drive is independent of that of the driving wheels, being connected to or disconnected from the main shaft by means of a splined coupling, thus permitting examination of the miller and allowing the machine to move from place to place under the same power without the miller being in motion. On the miller axle are mounted two sleeves, one on either side of the crown wheel casing, each of which carries eight coiled springs of special shape. On the extremities of these are fitted semi-circular hooks of hardened and tempered steel which attack the soil. This method of springing gives elasticity to the mechanism and allows the hooks to give way when meeting stones, roots or other obstacles. The miller is enclosed under a hood, which prevents stones and soil being thrown out. The standard width of the machine is 28in., but by removing the extension members carrying the two outer tines on either side, the track can be reduced to 22in., or the same as that of the travelling wheels. The depth of tillage is variable from 1in. to 10in., depending on the speed of the machine and the nature of the soil. This depth can be regulated at will. The machine weighs 5 cwt. and can be fitted with a mower, ridger or a truck, while for winter work the machine can be used as a stationary engine for driving stationary machines by means of a belt.

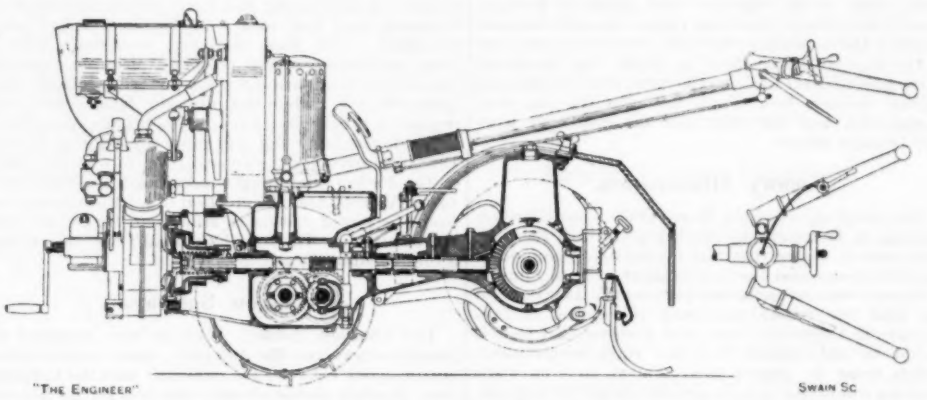


FIG. 2—8-H.P. SIMAR ROTARY TILLER

The latest practices in connection with the manufacture of flour are exemplified on the stand of Thomas Robinson and Son, Limited, Rochdale. The principal new appliances shown include a roller mill with all the most recent improvements, a conditioner, a combined wheat stoner, washer and rinser, and a cyclone pneumatic separator for cleaning grain. The last-named is also capable of separating by specific gravity other substances of a granular nature and materials which contain dust. A section of the apparatus is shown in Fig. 3. It will be seen that the material is fed into a vertical tube which conveys it through the centre of a fan and delivers it on to a revolving disc A. This disc is fixed inside a hood connected to the inlet of the fan. The stock, as it flows off the disc, is evenly distributed inside the hood, and is met by a swirling current of air. The cyclonic action of the air brought about by the construction of the machine has a beneficial effect on the stock, causing it to leave the disc in a gliding curve and ensuring the particles being subjected to the cleansing action of the air currents. All foreign matter or impurities—such as dust, sand, chaff, light and hollow grains—are lifted up by the fan and deposited in the expansion chamber B and the cyclone C. There is an adjustable valve by which the aspiration can be fully controlled. It is claimed that fully 90 per cent. of the removable substances are deposited in the expansion chamber B, whilst the remainder, containing the lightest dust, is carried by the returning air current into the cyclone chamber C. The machine is fitted with self-lubricating bearings. The principal feature of the combined wheat stoner, washer and rinser is the appliance for separating the stones from the grain. A section of this machine is given in Fig. 4. The wheat is fed into a circular copper tank B, up which there is a constantly flowing stream of water. The feed is delivered into the centre of this tank by means of a bell-shaped spout F, the lower edge of which is 2in. below the water level. This ensures that every grain of wheat is thoroughly submerged while in the machine. The water rising from below enters the tank by a spout feeding in the direction of its circumference, thereby creating a swirling action in the water. This swirling action is intensified as the water rises, by the action of diagonally placed vanes on the "torpedo" G, which is suspended in the

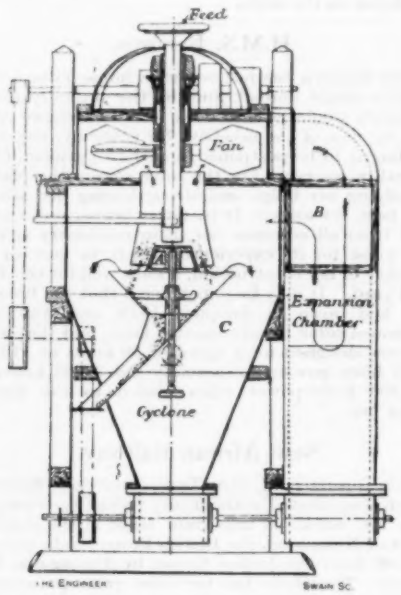


FIG 3.—ROBINSON CYCLONE GRAIN CLEANER

centre of the tank. The effect of this is to separate the stones from the wheat; the former, owing to their greater specific gravity, fall to the bottom, whilst the separated wheat flows over the sill B with the water. All parts which are liable to wear can be lifted out instantly for cleaning purposes without undoing a single nut or screw.

It sometimes happens that it is necessary to put an

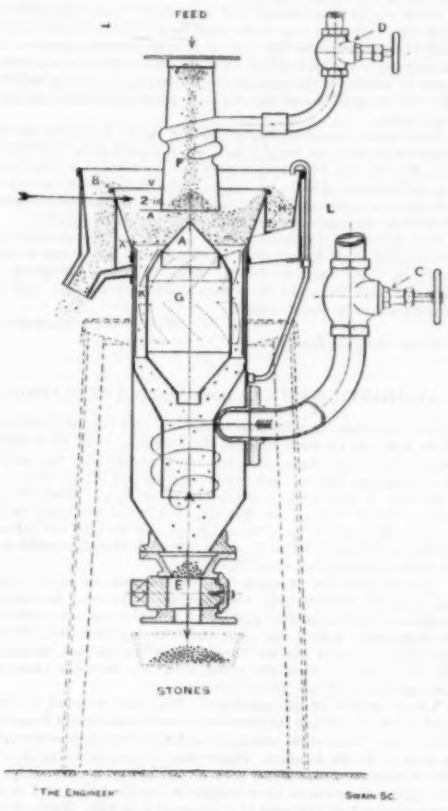


FIG. 4—ROBINSON WHEAT STONER AND WASHER

extra feed on the machine for a time. The extra water required is introduced through the bell-shaped funnel F at the top, instead of at the bottom; thus the extra feed does not in any way interfere with the stoning. Another feature is the elimination of the bubbles which are liable to get into the machine from the supply tank, and so interfere with the stoning. These are liberated by means of a patented feature, viz., the air escape pipe L. The "Mersey" stoner delivers the wheat through an adjustable spout into any part of the inclined rinsing worm, ensuring the wheat receiving the amount of water and washing it requires.

Messrs. Robinsons' radiator conditioner consists of a series of radiators built in sections and fed from a boiler with either hot water or steam. The damp wheat is fed into the top of the apparatus by an automatic feeder, and owing to the special construction of the radiators a constant stream of wheat is maintained throughout until the wheat finds an exit at the bottom. An even temperature is thus maintained and the grain is thus conditioned throughout. The radiators are supported in cast iron frames forming separate units, the number of which varies according to the capacity of the machine. Each unit is connected to the main air exhaust pipe through a controlling valve. The temperature of the water fed to each unit is indicated by thermometers, and the amount of water circulated is controlled by valves. The cooling sections consist of rolled steel channel legs fitted with louvre plates which turn the wheat over. The space between the sections forms the chamber through which cool air is drawn, this chamber being connected to the main air pipe. The feed apparatus is automatic and consists of a balanced bucket connected by a wire rope to a lever which actuates the delivery gates. The fan is of the centrifugal steel plate type, with a balanced rotor running in ball bearings.

Messrs. Robinson are also exhibiting a diagonal roller mill which embodies a new method of driving the feed rolls from the fixed roll spindle instead of from the adjustable roll, thereby obviating the adjustment of the driving belt when the feed is put in and out of gear. The drive is effected through a train of cut spur wheels running in an oil-tight box. This machine has also a micrometer adjustment for easily and accurately setting the rolls and automatic feed mechanism for the grain to give an even stream of material from end to end of the rolls.

Marshall, Sons and Co., Limited, Gainsborough, have a very comprehensive group of exhibits, including a portable steam engine—Fig. 5—a compound steam tractor, single-cylinder steam road roller and scarifier, single-cylinder steam traction engines, 12 and 16 horse-power portable oil engines, an all-steel thrashing machine—Fig. 8—and a mechanical flax puller—Fig. 10, page 12. The portable steam engine illustrated represents the latest development in this class of engine. It is made for a working pressure of 150 lb. per square inch, with single cylinder 7½in. diameter and 12in. stroke. The valve gear is of the piston type. Dustproof ring-oiler bearings are applied for the crank shaft. The cylinder is lubricated by means of a positive-action mechanical oil pump fitted with ball valves. The crosshead with adjustable slippers works in a circular bored guide of the Marshall pattern. The boiler is of an improved multi-tubular type with Marshall fire-box, corrugated smoke-box tube plate and reinforced front plate. The makers claim for these engines a very high mechanical efficiency and low fuel consumption. The oil engines shown by this firm are constructed to operate on the two-stroke cycle, the ignition of the fuel being effected partly by the heat of compression and partly by hot bulb on the cylinder cover. No water injection is needed under any conditions.

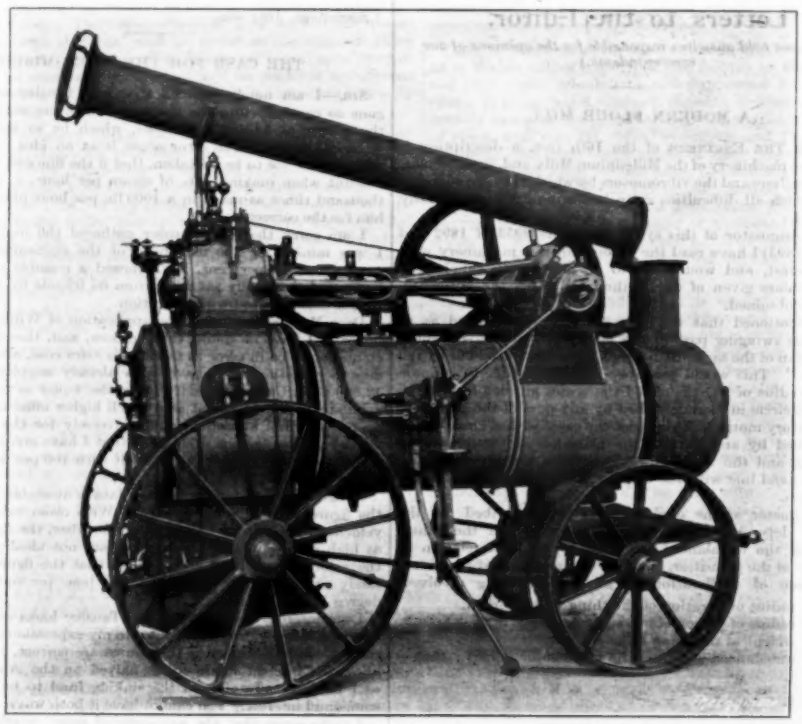


FIG. 5—MARSHALL PORTABLE STEAM ENGINE

The all-steel thrashing machine illustrated in Fig. 8, page 12, constitutes a new departure. The machine is of the "finishing" type, 4ft. 6in. wide, with large-capacity thrashing drum fitted with eight beaters. The frame is built up of steel sections and the sides and ends are finished with steel sheets. The machine has a straw rack, shoe containing a caving riddle of special design, and bottom hopper with special riddles for first dressing. The internal grain elevator has steel cups and is arranged for delivering the grain at the back end of the machine, direct into sacks if required, through the smutter and back-end dressing apparatus, or direct to the back-end dressing apparatus without passing through the smutter. The smutter is of the usual English type, and a back-end blower with back-end dressing apparatus, fourth blast, rotary corn screen for grading the grain into three different qualities, are included in the equipment. The bearings of the drum shaft, smutter shaft, main blower shaft, back-end blower shaft and the outside bearings of the shoe crank are all of the ball race type, self-aligning and highly efficient as regards

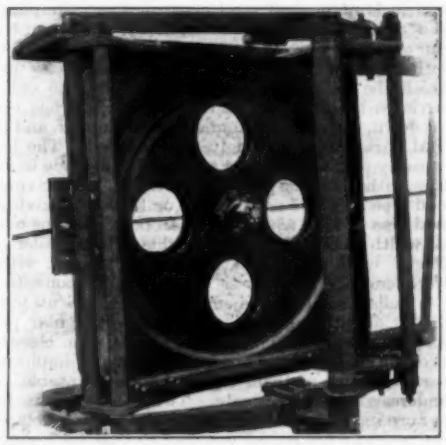


FIG. 6—SENTINEL TRAILER—FORE-CARRIAGE

lubricating devices and ease of running. The machine is mounted on four light wrought iron travelling wheels, and the usual draught attachments are provided. Its feeding arrangements are identical with those of the standard English wood machine, and there is ample space at the top of the machine for its convenient operation. This machine has been primarily designed for the farmer who is desirous to undertake his own thrashing; it can be driven by an oil tractor or an oil engine or by an electric motor if current is available. The output is said to be about 800 bushels of wheat per day of ten hours, and it is claimed that this output is obtained with less power than is absorbed by the ordinary type of wood thrasher. The weight of the all-steel machine is about 3½ tons only.

The mechanical flax puller—Fig. 10—has been

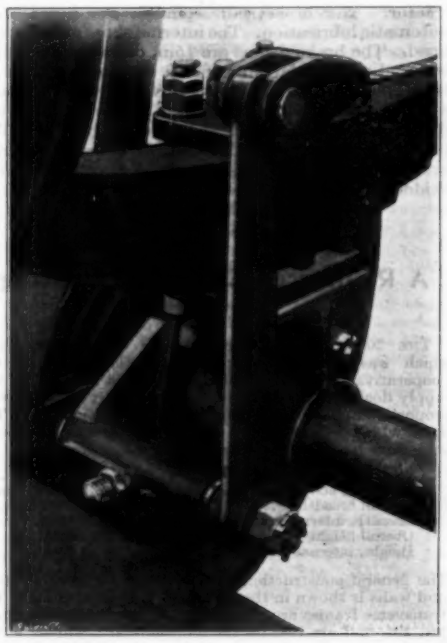


FIG. 7—SENTINEL TRAILER—BRAKE

placed on the market as the result of active co-operation between Marshall, Sons and Co., Limited, and the Fibre Corporation, Limited. It will pull the flax stalks and deposit them neatly in the rear of the machine, leaving practically all weeds standing in the ground. It can be drawn by horses or other draught animals, but it is best used in conjunction with an oil tractor. The machine consists of a rectangular frame carried on two wheels, one wheel being a driver and the other a carrier. The driving wheel actuates, by means of sprocket wheels and an endless chain, a horizontal driving shaft at the back end of the machine. This shaft imparts motion, through the medium of a clutch, to a travelling table formed by two endless chains and a series of steel

combs. The combs move rearwards as the puller is hauled forward and make a mechanically-controlled contact with the growing flax. The machine takes a 36in. swathe without injury to the fibre or risk of deseeding, and deposits the pulled flax at regular intervals as the machine moves forward. The complete machine only weighs about 18 cwt. and will pass through a 9ft. gateway. Highly satisfactory work with machines of this type was, it is said, done in flax-growing centres at home and abroad during the 1921 harvests, pulling from five to ten acres of flax per day according to the nature of the crops.

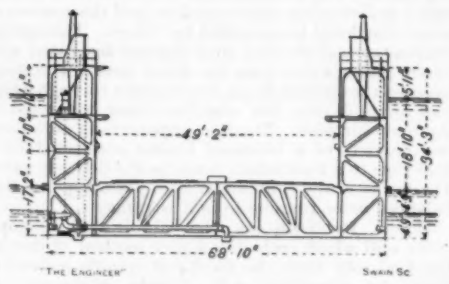
In Figs. 6, 7, and 9 (page 12) are given views of a new trailer for road purposes, built by the Sentinel Waggon Works (1920), Limited, Shrewsbury. This vehicle is of pressed steel construction. Simplification of detail has been effected by making use of four one-piece pressed steel turntable units which form both the cross members of the frame, the circles upon which the undercarriages can turn, and the undercarriages themselves. In this way weight has been cut down, the cost of manufacture minimised, and the vital parts correspondingly strengthened. The load capacity of the trailer is 4 tons, and it is made in two sizes, either with a platform 13ft. 6in. long, giving a load area of 87.75 square feet, or 15ft. long, giving a load area of 97.5 square feet. In both sizes the overall width is 6ft. 6in. The weights of the trailer are 28 cwt. with a 13ft. 6in. length, and 30 cwt. with a 15ft. length. The chassis of the trailer consists of two rolled steel side members which are attached rigidly at either end to two steel rectangular pan-shaped pressings. These pressings have an elevated circle or chase pressed out in the centre or diaphragm part, and two of them together form turntable and undercarriage respectively. The front two are free to turn and are retained in place by a perch bolt and the rear two are bolted together so that they cannot turn. This pressed steel construction, besides simplifying the design, also reduces the amount of wear on the circles themselves, because, whereas in the old form of construction the circles were separate and bolted to cross beams which did not support them all the way round, the circles, being formed in one piece with a strong yet flexible diaphragm, are perfectly supported everywhere and lie absolutely flat. The perch pin is arranged in the centre of the front pair of pressings. It is 2in. in diameter, is enclosed in an oil bath, and is fitted with a powerful spring, whose function it is to hold the two circles closely in contact and thus prevent chattering between them, which is one of the most frequent and destructive causes of wear. The axles are specially strong and have journals 2¼in. diameter by 9in. long, and the wheels are of the hollow-spoked cast pattern. The brakes are of the internal expanding type and are actuated either by a handle at the side of the vehicle—for use when the trailer is standing alone—or can be connected and applied from the cab of the tractor. The brake cam spindles are fitted with automatic lubrication. The internal shoes are asbestos lined. The brake drums are 15in. diameter and 2½in. wide. Locking plates are fitted on the front pair of turntables. These plates are provided with holes and a pin and are capable of locking the turntables in ten different positions within 18 deg. of each other. The trailer can therefore be backed on a predetermined arc of a circle with ease, and the danger of its being skidded sideways is thereby obviated.

A Reinforced Concrete Floating Dry Dock.

THE 2000-ton reinforced concrete floating dry dock which was recently completed and launched by the Cooperativa Edilizia della Regione Guilia at Trieste, will supply docking accommodation at that port for the larger proportion of the ships engaged in the Adriatic trade. The dock, which presents some interesting features in its construction, has the following general dimensions :—

Overall length, including ends	210ft. 6in.
Length of body	171ft. 1½in.
Overall breadth	68ft. 10in.
Breadth, internal	49ft. 2in.
Overall height	34ft.
Height, internal	23ft.

The general construction of the framing of the pontoon and walls is shown in the accompanying illustration. The transverse frames are spaced at a distance apart of about 3ft. 4in. and are tied by the longitudinal members of the upper and under decks and the inner and outer walls. The pontoon of the dock is subdivided into six water-tight compartments by means of one longitudinal and two transverse water-tight bulkheads, and each of the lateral caissons is further divided by two vertical walls and braced by diagonal struts. The same construction is adopted in the side walls, with the exception that the upper section is left clear and is provided with windows in the outer wall. The space thus enclosed is utilised to house the motors for driving the pumps and also to accommodate the repairing shop. The dock is furnished with four 3-ton cranes, which are placed at the four ends of the top wall and serve the workshops and the ship in the dock. It will be noted that the pumps are placed in the lower compartment of the caisson and that connection is made to the various dock compartments by pipe lines, the vertical spindles driving the pumps passing upwards to the motors in the top compartment. At each end of the dock there is a platform, which extends outwards a little over 6ft. and is carried by supports. The depth of steel sections used in the framing vary from 4in. to 11in. and the reinforcing material consists of bars from ⅜in. to 1³/₂₂in. diameter. Special reinforcement necessary to meet launching conditions is provided in the upper and lower decks and the walls. The dock was launched sideways on three launching ways, each about 6ft. wide, which were built of American pine and spaced at 52ft. intervals. Over 20,000 cubic feet of concrete were used. The total finished weight of the dock, including the machinery, is about 1700 tons, and when empty it floats at a draught of 4ft. 9in. To render the surface of the concrete impervious to water a cement composed of one part of Portland cement to three



CONCRETE FLOATING DOCK

parts of sand was laid on by trowel to a thickness of approximately ¼in.

According to our contemporary *Le Génie Civil*, to whom we are indebted for particulars of this construction, the dock described is not the first to be built in reinforced concrete. During last year another dock was built at Minden, in Germany, which was about 262ft. in length, 12ft. broad, and 10ft. high, and which is used, not only for repairs, but also for the building of ships up to about 1500 tons weight. In constructing the dock a modified form of the cement gun process was used, the concrete being projected on to thin concrete plates which were previously prepared in moulds.

INSTITUTION OF MECHANICAL ENGINEERS.

IN concluding our brief account of the meetings of the Institution of Mechanical Engineers we omitted to record that in bidding farewell to the Liége Association of Engineers the President took the opportunity to lay a wreath upon the memorial erected to the memory of Liége engineers who had fallen in the war, which was unveiled in the house of the Association on the preceding Sunday. This courteous action was greatly appreciated by the representatives of the Association, whose speakers referred in the warmest terms to the friendly relations which had been established by the visit. It is satisfactory to know that, following the precedent of others who laid wreaths upon the memorial, the Institution has given instructions that a permanent bronze wreath with an appropriate inscription shall be placed thereon.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

A MODERN FLOUR MILL.

SIR,—In THE ENGINEER of the 16th inst. a description is given of the machinery of the Millennium Mills, and, in particular, of the plansifters and the vibromotors by which they are operated and by which all difficulties as to balancing are automatically eliminated.

As the originator of this system (Patents 9953 of 1892 and 20,148 of 1893) I have read the account of this machinery with much interest, and would ask to be allowed to supplement the particulars given of the method by which the automatic balance is obtained.

It is mentioned that the plansifter is so suspended as to "allow the swinging part of the machine to describe a small circle in plan of the same diameter as the circle traced out by the crank pin." This would probably lead the reader to suppose that the radius of what is called the crank pin determines the size of the circle in plan described by any part of the plansifter in its gyratory motion. This is not the case, as that circle would be described by any part of the plansifter if there were no crank pin, and the short vibromotor weight shaft were connected in axial line with the driving shaft by any freely acting articulation.

The diameter of the circle of gyration described by the plansifter depends on the weight and radius of the centre of mass of the unbalanced vibromotor weight in relation to the weight of the plansifter, and may be simply found as follows, no question of acceleration or momentum being involved.

Let R = radius of gyration of the thing to be worked.
r = radius of vibromotor weight mass centre.
W = weight of the thing to be worked.
w = unbalanced weight of the vibromotor weight ; then—

$$\frac{r}{R} = \frac{W}{w} \qquad r = R \times \frac{W}{w}$$

$$R = \frac{r}{\frac{(W)}{(w)}} \qquad W = \frac{r}{R}\,w, \text{ and}$$

$$w = \frac{W}{\frac{(r)}{(R)}}$$

When the thing worked is of large dimensions and large stroke or radius of gyration is required, as in the plansifter described, it is desirable to give the vertical driving shaft a set off as shown in your engraving, Fig. 27, and this set off or crank, if given a radius = R, will enable the driving shaft, when the intended speed of rotation has been reached, to rotate on its own axis.

With large machinery, in which the heavy driving shaft has considerable influence, it is desirable to adopt the set off, whether the driving shaft be rigidly attached as shown, and the vibromotor bearing of swivel freedom, or whether the driving shaft be articulated at a vibromotor spindle set off = R, and with a fixed instead of a swivelling bearing.

When a rigid connection of the driving shaft and the vibromotor shaft is made, as shown in your drawing, Fig. 27, it becomes necessary to mount the vibromotor bearing with a swivelling freedom as shown.

With smaller machinery and very small range of gyration, with which the driving shaft may be a mere rod with a free hooked connection to the top of the vibromotor spindle, the driving shaft in rotation follows at its lower end a circular path, equal in radius at the vibromotor to that of the thing worked. The conical gyration of this rod is of little importance in small machinery.

The rigidly attached heavy driving shaft, if not so set off, becomes an effective weight, half of which acts as a vibromotor at radius R, and, even with a very free connection at the top of the vibromotor spindle, it causes some interference partly in the plane of gyration of the thing worked and, in minor degree, as vertical resultant of its angular cone-describing rotation.

The details of the driving shaft and its connection with the vibromotor shaft have taken various forms, as in the bolters made in large numbers by the Allis Chalmers Company, in America, and by other flour mill machinery makers, and by paper machinery constructors.

W. WORBY BEAUMONT.

Outer Temple, June 29th.

AVOIDABLE WASTE IN LOCOMOTIVE OPERATION.

SIR,—In drawing attention to the low coal consumption rate of 26.9 lb. per 1000 ton-miles of the Virginian 2–10–10–2 Mallet locomotives, my object was not to disparage the working of these engines, but to elicit some explanation of the figures in question. I was greatly interested in reading "C. R. K.'s" reply in your issue of the 2nd ult., but it did not seem to me to clear the matter up. Some light is now let into the subject by the informative letter from Mr. Wm. T. Hoecker, published in your impression of June 23rd.

According to Mr. Hoecker, the explanation, in part, is that the rate of 26.9 lb. was obtained on runs over favourable gradients, for the greater portion of which steam was shut off. Consequently, during the time that the regulator was closed, the engines would not be burning coal for hauling purposes. On this basis, I certainly agree with Mr. Hoecker that the ton-mile unit is of very little value.

Let us glance at the gradients. The runs referred to were made on the Virginian Railroad between Princeton and Roanoke, 97.1 miles. Soon after starting from Princeton, the line descends at 1 in 67 for 19.4 miles. Then come 33.1 miles rising at 1 in 500, followed by 9.4 miles at 1 in 167 up. The remainder of the run to Roanoke is all downhill, 8.7 miles being at 1 in 67, 8.8 miles at 1 in 120, and 17.7 miles at 1 in 167. Thus, of the total distance of 97.1 miles, 54.6 miles are on descending grades, and 28.1 miles fall as steeply as 1 in 67. The trains with which the rate of 26.9 lb. of coal per 1000 ton-miles was obtained weighed, in one case, 15,725 tons, and, in the other, 12,070 tons. These are presumably short tons. With such loads, the down gradients, as suggested by Mr. Hoecker, would obviously have to be descended "without steam," hence the overall coal consumption would necessarily be very low indeed.

For purposes of comparison, the ton-mile basis does not seem to be of any use apart from any particular railway or section of that railway. The coal burnt per drawbar horse-power per hour is a far better guide, of course.

F. W. BREWER.

Stevenage, July 4th.

THE CASE FOR THE ECONOMISER.

SIR,—I am much gratified that Mr. Tansley should have gone so carefully into the points raised in my article, even to the extent of finding a mistake, which he so kindly calls a "clerical error." The error arose from an idea in my mind, which I now see to be mistaken, that if the flue gas fell a certain amount when making 1 lb. of steam per hour, it would fall a thousand times as much in a 1000 lb. per hour plant. I thank him for the correction.

I am sorry that Mr. Tansley gathered the impression that I was minimising the usefulness of the economiser. All my curves over 10 per cent. L.F. showed a possible net gain by its use. I was really saving it from its friends by pointing out that it must be used with discretion.

Does Mr. Tansley allow the application of Willan's law to a boiler ? I have no doubt that he does, and, therefore, I must claim not to be in error in taking the *extra* coal, after the losses due to radiation, &c., have been already supplied, to be at 12,500 B.Th.Us. per pound. Once the boiler is under steam, *extra* steam can be raised at a much higher efficiency than the overall thermal efficiency, and conversely for the saving. It will be noticed, on the other side, that I have credited the heat transference in the economiser itself with 100 per cent. thermal efficiency.

A vast amount of experimental data is available for checking the figure which I have called 3. With clean tubes and high velocities, both inside and outside the tubes, the figure may be as high as 5, but economiser tubes are not ideally clean, and the velocities are both very low, so that the figure cannot be safely taken as over 3 B.Th.Us. per hour per square foot per degree Fahrenheit.

I am interested in the way Mr. Tansley looks at economiser finance. Any figures can be put into my expressions, and correct results will be obtained if the figures are correct, but I cannot allow the interest figure to be halved on the grounds stated, as I have already allowed the sinking fund to be invested at compound interest. You cannot have it both ways.

I quite agree that the aggregate of many yearly savings is surprisingly great ; but, with a badly planned installation, the aggregate *loss* is equally surprising.

JULIUS FRITH.

Manchester, July 5th.

THE reconstruction of the aircraft carrier Furious, which arrived at Devonport recently from Rosyth, will provide the West Country yard with one of the most important pieces of work entrusted to it during the current financial year

Railway Matters.

THE first railway to be absorbed into the Southern Group is the Isle of Wight Railway, which will become part of the London and South-Western as from January 1st next.

ON the 28th ult. Mr. Arthur Neal stated that during the first five months of the present year there had been 623 broken couplings or draw-bars on passenger trains and 2558 on goods trains.

THIRTY-FOUR electric locomotives have been ordered from the English Electric Company for the Imperial Railways of Japan. This order was obtained in the face of strong competition from the United States.

A PROVISIONAL agreement has been arrived at between the London and North-Western Railway Company and the North London Railway Company, whereby the latter is to be absorbed as from January 1st last. As the North London is a subsidiary and not a constituent company, this is only a small further step towards the completion of the North-Western, Midland and West Scottish Group.

IN this column of our issue of the 16th ult. we explained how the compiete amalgamation of the South-Eastern and London, Chatham and Dover Railway Companies would strengthen the poaition of those companies in arranging their status in the Southern Group. Terms for this amalgamation have now been agreed upon, and the new South-Eastern and Chatham Railway Company will come into being as from January 1st next.

IN an appendix to the report of the Automatic Train Control Committee there are published the number of signal boxes, distant signals and stop signals on sixteen of the principal British railways. These railways have a track mileage of 29,671, with 11,016 signal boxes or 1 for every 2.69 track miles, 29,468 distant signals or 1 for every 1.01 track miles, 58,230 stop signals or 5.28 for every signal box and 21,806 locomotives.

THE Postmaster-General and the railway companies have recently come to an agreement as to the rates for the conveyance of parcels post hampers, bags, &c., and the terms were announced in the House of Commons by Mr. Pike Pease a fortnight ago. Since the parcels post was established, the companies have received 55 per cent. of the postage. This has now been reduced to 40 per cent., and in return the Post Office agrees not to re-establish the parcels road coaches between certain towns. As the 55 percentage was mentioned in the Act of 1882 establishing the parcels post, an amending Act will be necessary.

ON Monday next, the 10th inst., the Chalk Farm Widening of the London and North-Western Railway Company will be opened throughout. From that day, in addition to the electrical services given by the Elephant and Castle–Watford trains, there will be electrically operated trains between Euston and Watford and Broad-street and Watford. During the busier hours of the day there will be four trains an hour between each of these three points, and in the quieter periods a half-hourly service will be given between Euston and Watford and Broad-street and Watford. Chalk Farm, South Hampstead (formerly Loudoun-road), and Kilburn stations will be reopened.

ON August 9th the reconstruction of the portion of the City and South London Railway between Euston and Moorgate stations will be commenced, and a three-minute motor omnibus service has been arranged to run from Euston-road to Moorgate *viâ* Drummond-street, Seymour-street, Pentonville-road, City-road, Finsbury-pavement and Moorgate. The omnibuses will only stop at the closed Underground stations, and in order to distinguish these vehicles from the standard red General omnibuses operating in the same districts, they will be painted a different colour, probably blue or green, and will therefore be easily recognisable.

THE Stationery Office has recently published a volume of railway statistics compiled for the Ministry of Transport as to the quantities of selected commodities carried by the railways in Great Britain during certain periods in 1920 and 1921. They cover the tonnage conveyed each mile up to 50 miles and in mileage groups beyond that distance; the corresponding gross receipts, including station and service terminals and receipts per ton-mile; the average length of haul; the average receipt per ton-mile. Particulars are given for the fifteen principal companies and totals for all the railways. The price of the publication is 30s.

ACCORDING to the Board of Trade returns, the value of the railway material exported during the first four months of the present year was as follows, the corresponding figures for 1921 and 1920 being added in brackets:—Locomotives, £2,341,566 (£2,512,263, £1,287,245); rails, £1,297,255 (£1,568,681, £522,351); carriages, £680,342 (£521,812, £398,632); wagons, £1,754,585 (£2,318,031, £1,794,741); wheels and axles, £586,614 (£867,626, £611,430); tires and axles, £200,464 (£593,970, £406,397); chairs and metal sleepers, £839,556 (£694,261, £143,738); miscellaneous permanent way, £626,522 (£1,157,506, £669,443); total permanent way, £3,633,931 (£5,010,179, £2,396,391). The weight of the rails exported was 123,341 tons (69,924 tons, 29,747 tons) and of the chairs and metal sleepers, 59,877 tons (28,371 tons, 6783 tons). Locomotives to the value of £174,063 and rails to the value of £183,846 were shipped to India during April last.

THE new railways which the Union Government of South Africa has decided to construct, as announced by Mr. Jagger, Minister for Railways, in moving the second reading of the Railways Bill in the Union House of Assembly on June 21st, are as follows:—Belmont to Douglas, Dunswart to Apex, Ermelo to Lothair, Fort Beaufort to Balfour, a 2ft. gauge line from Frankfort to Villiers joining up with the Transvaal–Natal main line, Franklin to Kokstad, Franklin to Matatiele, George to Knysna, Harrismith to Warden, Heilbron to Petrussteyn, Hercules to Magaliesberg, Kamfersdam to Wintersrush, Klipdale to Bredasdorp, Lydenburg to Olifantspoortje, Nylstroom to Vaalwater, Oudtshoorn to Calitzdorp, Rustenburg to Boschhoek, Senekal to Marquard, Settlers to Tuinplaats, Touwariver to Ladismith, Upington to Kakamas, and a 2ft. gauge line from Zastron to Wepener. Practically all will be agricultural lines.

Notes and Memoranda.

THE annual production of lead from the Bawdwin mines is said to be now sufficient to supply the requirements of India and Ceylon, where there is a consumption of 15,000 to 16,000 tons yearly.

A NOVEL freight for an aeroplane will take the form of a racehorse when Pucka Sahib is sent to Spain. The owner says that the horse is always injuriously affected by railway travelling, so he is sending it by air this time.

A SINO-BRITISH Trade Association has been established in London for the development of trade between England and China. Membership is restricted to Chinese and British merchants carrying on business in China, Hong Kong, the Straits Settlements, and the Federated Malay States. The general management of the Association has been placed in the hands of Humphrey and Lenham, Limited, 77, Knightsbridge, London.

THE existence of lead deposits in Nigeria carrying varying amounts of silver has been known for the past twenty years. The ore occurs irregularly in pockets. The deposits are along a line, approximately north to south, and have been traced from the Afikpo district in Southern Nigeria to the Muri province, north of the Benue River, a distance of some 100 miles. The southern area was first investigated in 1903 by the Mineral Survey conducted in connection with the Imperial Institute, the report of the surveyors being unfavourable. Several attempts have since been made to develop the deposits, but hitherto without success.

A GOOD illustration of the advantage of the interconnection of electricity supply systems was recently given at Ontario, where, owing to accidents at two generating stations, the Hydro-electric Power Commission was suddenly deprived of about 166,000 horse-power. Within fifteen minutes of the occurrence the Canadian Niagara Falls Power Company and the Toronto Power Company were feeding the system of the Commission, and part of the deficiency is also being supplied by the American plant of the Niagara Falls Power Company, so that the whole of the municipal power and lighting service in Ontario was maintained without interruption.

THE largest fire float in the East, according to *Indian Engineering*, was recently launched in Calcutta. The dimensions of the float are:—Length overall, 107ft. 6in.; length between perpendiculars, 103ft.; beam moulded, 18ft.; depth, 6ft. 9in.; draught, 5ft. She is propelled by twin compound surface condensing engines which give a mean speed of 11 knots, is equipped with two horizontal water-tube quick steam-raising type boilers, and is coal fired. The fire and salvage pumping engines comprise two Merryweather sets, with a total pumping capacity of 4000 gallons per minute. The auxiliary equipment includes a separate condensing set with air pump and a 100-volt electric generating set.

MOST technical societies are, says the *Engineering News Record* of New York, seeking to increase their usefulness to their members. "We suspect that no other one thing they might do could accomplish more to that end than would the elimination of the interminable and ofttimes irrelevant discussions that drag out so many technical meetings until all hours. In some of the large cities many members live out of town and must catch certain trains. Frequently these men, who have gone to the trouble and sometimes incurred the expense of staying in town for the meeting, must hurry off in the middle of the discussion because one or two have been permitted to fritter away precious minutes on airy nothings."

THE official report on the explosion of a steam separator at a Welsh colliery ascribes the failure to the thinness of the end plate, which was not supported by stays. The plate, it is assumed, panted, causing cracking, which ultimately brought about its failure. The separator was made of steel, and was 2ft. 6¾in. in height and 18¾in. external diameter, the shell being made of steel plate ⅜in. in thickness, with the longitudinal seam fire-welded. The bottom was a steel plate ⅜in. in thickness, secured to the shell by fire welding. The top was a steel plate ⅜in. in thickness, secured to the shell by means of a riveted angle ring to which it was secured by bolts. The inlet and outlet branches were electrically welded to the top and shell plates respectively.

THE graphite in Madagascar is almost entirely of the flake variety, and occurs in schists and gneisses in the older crystalline rocks, which extend over two-thirds of the island. The deposits are confined, so far as is known, to the eastern side of the island. There are two producing tracts of country, a plateau region in the interior and a lowland region near the coast. In the former, graphite is generally found in graphitic schist, but sometimes as irregular pockets in vein formation. In the coastal area graphite is obtained from decomposed surface material, derived from gneiss, which, being non-coherent, is easily excavated. The Chief of Mines has estimated the reserves to be 10,000,000 cubic metres of marketable graphite, ignoring mineral below a depth of 100 m. The disseminated deposits may show contents as high as 60 per cent. of graphite. The average amount of flake mineral in normal deposits is 20 to 30 per cent., but a deposit with only 10 per cent. is considered workable.

COMMENTING on the objection sometimes raised in this country against British Columbia timber, on account of its liability to dry rot, the Timbers Committee remarks that it is the practice to ship the timber green and often wet from the water, and that for financial and other reasons it is not possible for the British Columbia mills to carry large stocks of timber in stacks for air seasoning before shipment. There is also the difficulty of climate in ordinary air seasoning as understood in this country. The Committee has little doubt that these circumstances, combined with the long voyage to this country, are responsible for the liability of the timber to dry rot and doat, but considers that the more favourable conditions resulting from the shorter voyage *viâ* the Panama Canal should result in an improvement in the condition of the timber when it reaches this country. The Committee is of opinion that, with proper treatment, British Columbia Douglas fir will be found not more liable to dry rot and doat than other coniferous timbers.

Miscellanea.

IT is proposed to construct a hydro-electric plant on the Great Brak River, South Africa, equipped with a 1200 horse-power Pelton unit.

NEGOTIATIONS between the Government and the consortium of banks have resulted in the adoption of a plan for the reorganisation of the Industrial Bank of China.

WORK is to be resumed at the copper mines of Messina (Transvaal) Development, and it is hoped that with the remodelled plant the extraction will be raised from the old proportion of 70 per cent. up to 85 per cent.

AT the annual meeting of Scottish Oils, Limited, it was stated that the various mines and works of the associated companies are now practically all in operation. The refinery at Uphall has been modified, and in the future it is intended to deal with Persian crude oil at these works. Satisfactory progress is reported in connection with the Grangemouth refinery scheme. Railway sidings and roads have been made, and a jetty has been constructed at Grangemouth Docks. The erection of a number of storage tanks is being proceeded with.

WE are informed by Mr. J. W. Meares that the post of Electrical Adviser to the Government of India, which he has held for some time, will shortly be abolished, and the Department of Industries will carry it on for a time. The post of Chief Engineer, Hydro Electric Survey of India, will also be abolished early next month, and the Public Works Department will settle up any outstanding matters of correspondence, &c. No more reports will be issued from Mr. Meares' office, and no further publications should be sent to him in India.

APPLICATION has been made by the American Superpower Corporation for a preliminary permit covering the use of 12,000 sec.-ft. of water, to be diverted at Niagara. The applicant estimates that 34,188,000 dollars will be required for the construction of the works necessary for the generation of 450,000 horse-power, under a head of 301ft. at 88 per cent. efficiency. The power-house would be equipped with nine units of 50,000 horse-power each, to be stepped up to 110,000 volts for local distribution and to 220,000 volts for transmission to New York.

THE possibilities of wireless telephone in connection with mine safety and mine rescue work have been suggested to the United States Bureau of Mines. The suggestion has been made that by use of high-power sending stations at the Bureau's experiment stations at Pittsburg, Pa., and Salt Lake City, Utah, messages could be broadcasted to the various mine safety offices and cars stationed throughout the country. Aerials have been installed on trains in Germany, and it is pointed out that it would be entirely possible to build similar aerials on the mine-rescue cars of the Bureau of Mines.

THE chief engineer of the Gas Light and Coke Company, MR. Thomas Hardie, in his presidential address to the Institution of Gas Engineers, said that the passing of the Gas Regulation Act was proving a great incentive to inventors. The Act had been rightly described as a charter of freedom. The change by which the sale of gas was by therms instead of cubic feet had proved satisfactory. Further developments in gas would result in an extended conservation of our national resources, increased efficiencies and economies in the industrial world, and healthier conditions in our towns and in the homes of the people.

THERE appears to be an increasing demand for small lighting plants for public buildings in the country towns in Argentina, and also for farming purposes, especially in the northern part of the republic. The most popular lighting unit appears to be an oil or paraffin set, capable of supplying electricity for forty to seventy 16 candle-power lamps or a 4-kilowatt set for cinemas. Some German firms have already entered the field, and the Siemens-Schuckertwerke has recently introduced a new set. It must be remembered that small lighting installations must be economical in first cost as well as in operation.

"IF Italy has to choose between buying coal at the same price between America and Britain, she will buy from Britain," said Signor Boriello, who is one of an influential deputation of Italian commercial magnates now visiting England. "The recent fall in British shipping charges," he added, "has made a great deal of difference, as America is handicapped by the great distance her coal has to be carried. It is to be hoped that your railway rates for coal transport will shortly also be reduced, to enable coal to be sold still more cheaply. It is only by still cheaper coal that Great Britain can consolidate her gains in the Italian market."

A WELCOME item of news to Hartlepool people is the announcement that Irvine's Shipbuilding Company, Limited, has secured the contract for the completion of a steamer—the Zabalbide—the hull of which has been built on the Tyne. The Zabalbide is being built for Spanish owners, the Compania Maritima, of Bilbao, the earlier stages of her construction having been carried out by the Newcastle Shipbuilding Company, Limited. The machinery for the Zabalbide is being supplied by the North-Eastern Marine Company at Newcastle, and as soon as it is installed the vessel will be towed to West Hartlepool to be completed at Messrs. Irvine's Middleton Shipyard, where it is expected she will arrive in about a month's time.

THE Joint Committee of industrial and shipping interests—representing the Federation of British Industries, the London Chamber of Commerce, the Associated Chambers of Commerce, the Port of London Authority and the Short Sea Traders—formed to consider the question of the navigation of the Upper Rhine, has indefinitely suspended its sittings in view of the satisfactory nature of the decisions reached by the plenary Rhine Commission at Strasbourg in May. Although the Commission agreed to the French scheme for a lateral canal of about 2½ miles on the Kembs section, the expense of such canalisation being borne by the French, for the regularisation of the rest of the Basle-Strasbourg section of the Rhine Canal, the Commission decided to adopt the Swiss scheme, the expense of the work being divided among France, Germany and Switzerland. The plenary Commission will have control over the river and the canal, and guarantees have been effected against favouritism being shown to any one nation.

SOME EXHIBITS AT THE ROYAL SHOW

(*For description see page 8*)

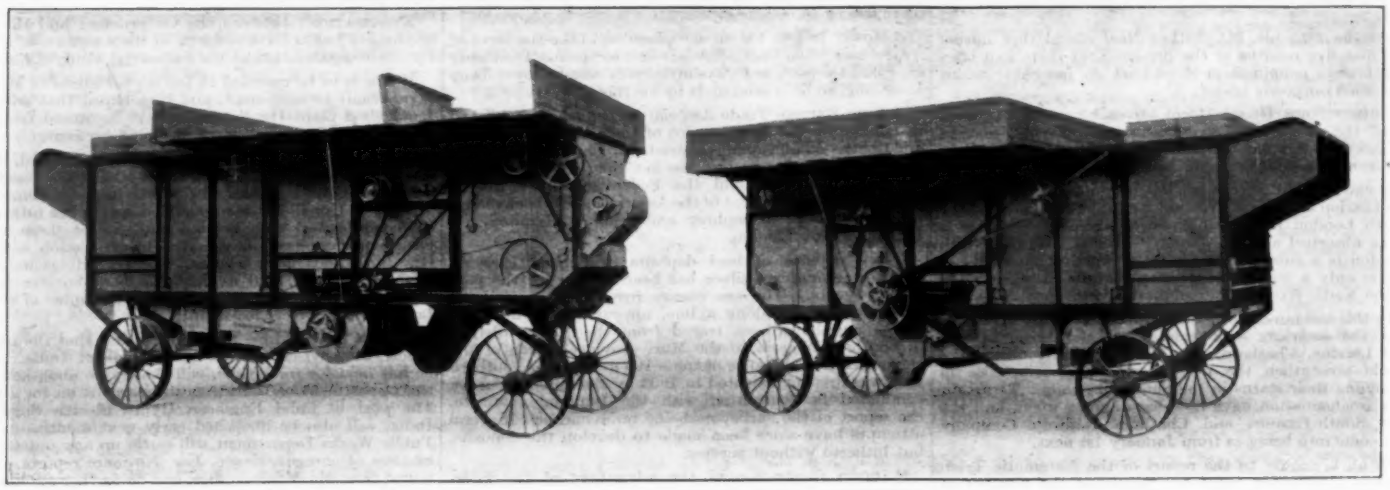


FIG. 8—MARSHALL ALL-STEEL THRASHING MACHINE

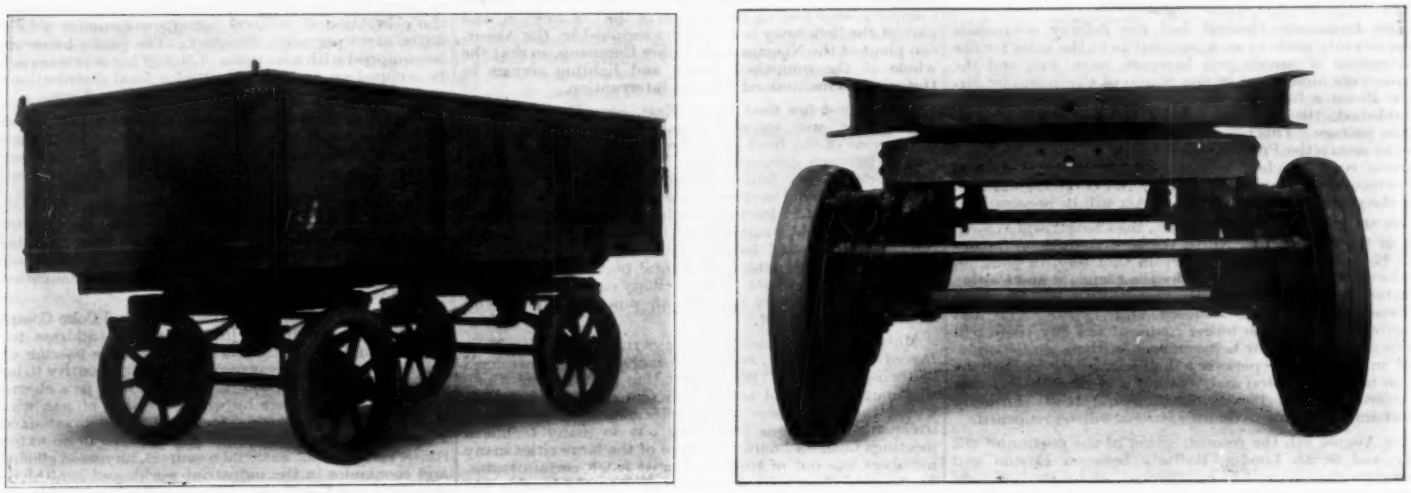


FIG. 9—SENTINEL ALL-STEEL TRAILER WAGON

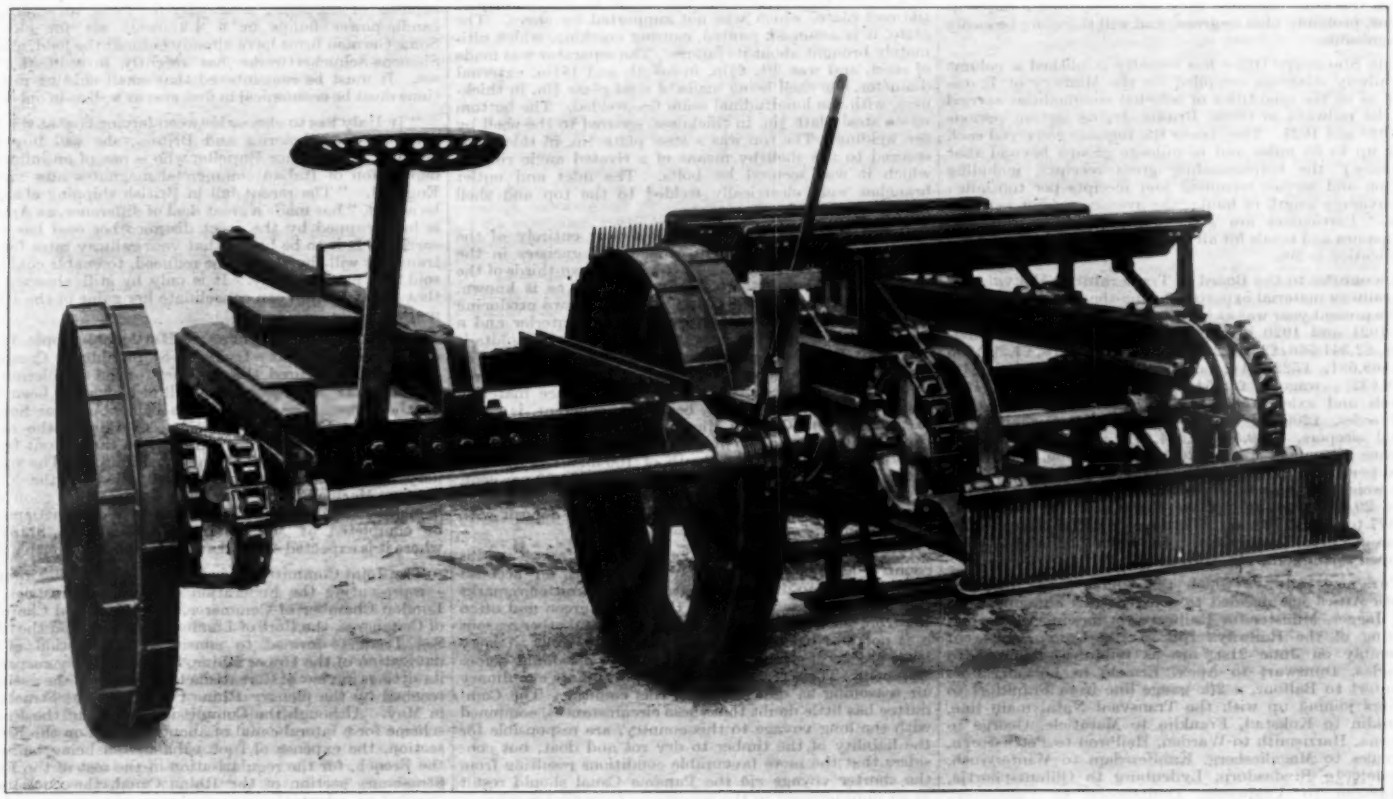
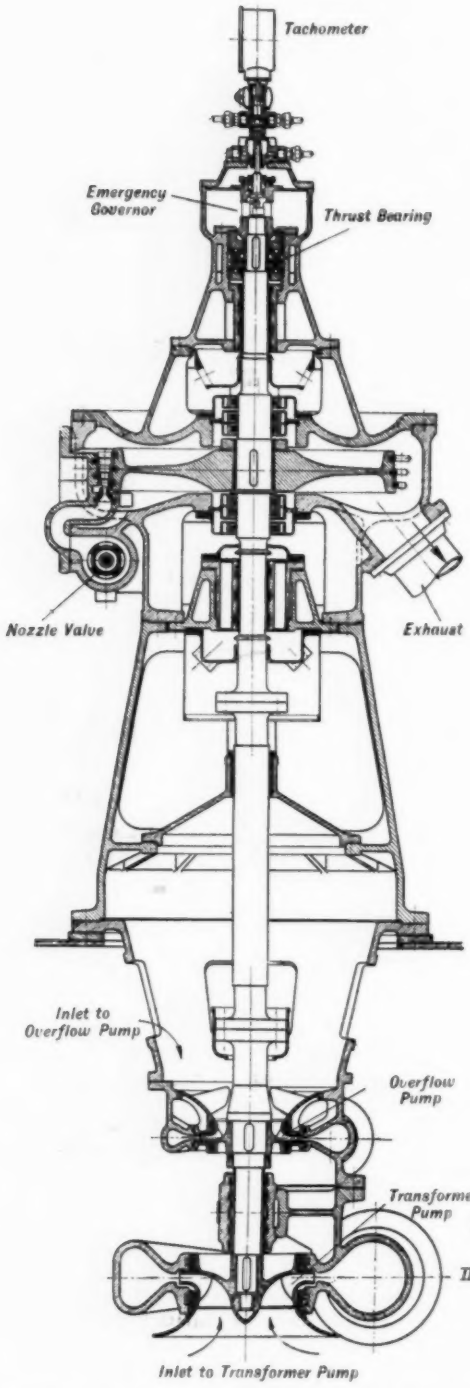
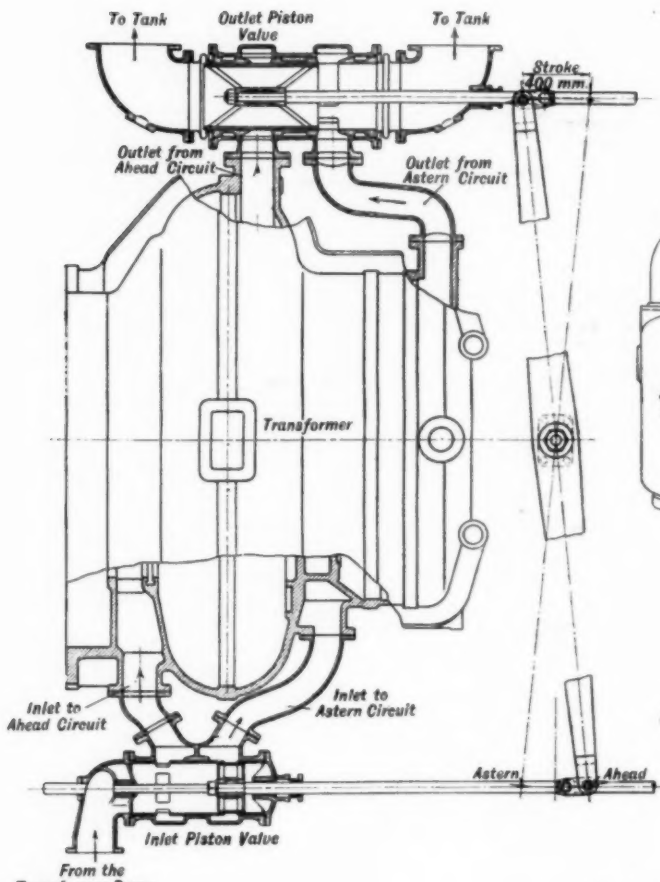


FIG. 10—MARSHALL MECHANICAL FLAX PULLER

FOETTINGER HYDRAULIC REVERSING AND REDUCING GEAR ON



SECTION THROUGH TRANSFORMER PUMP



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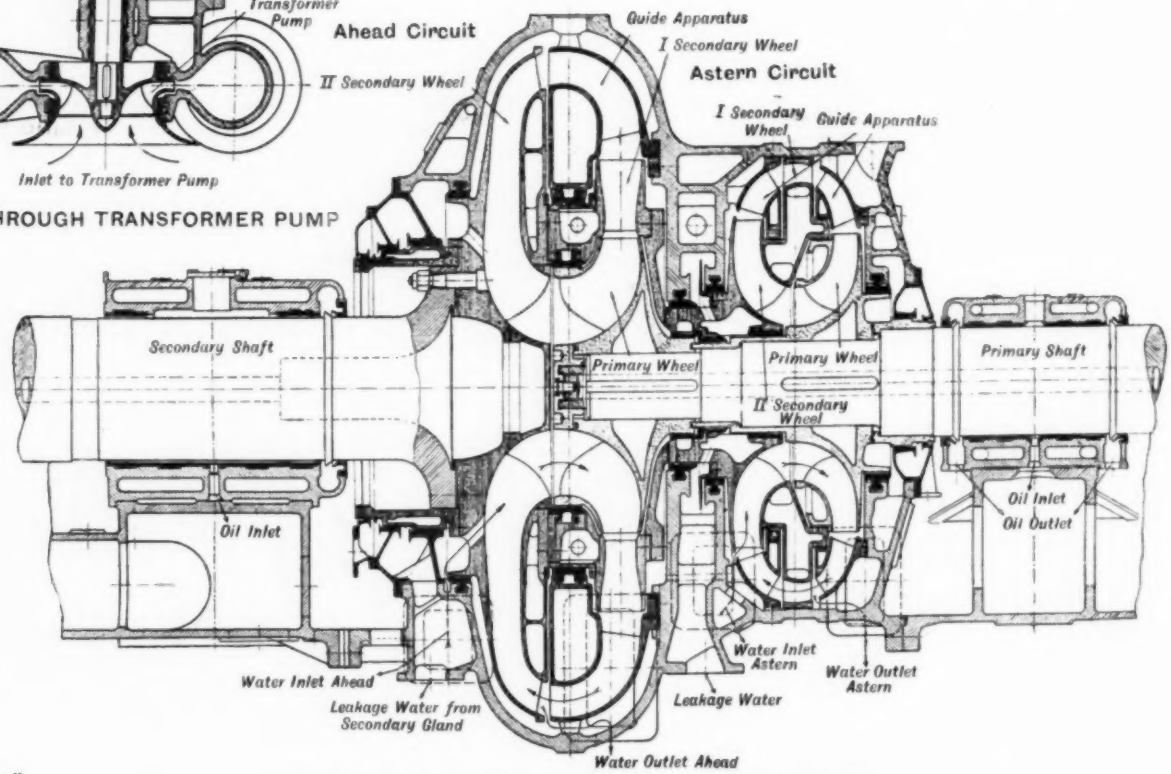
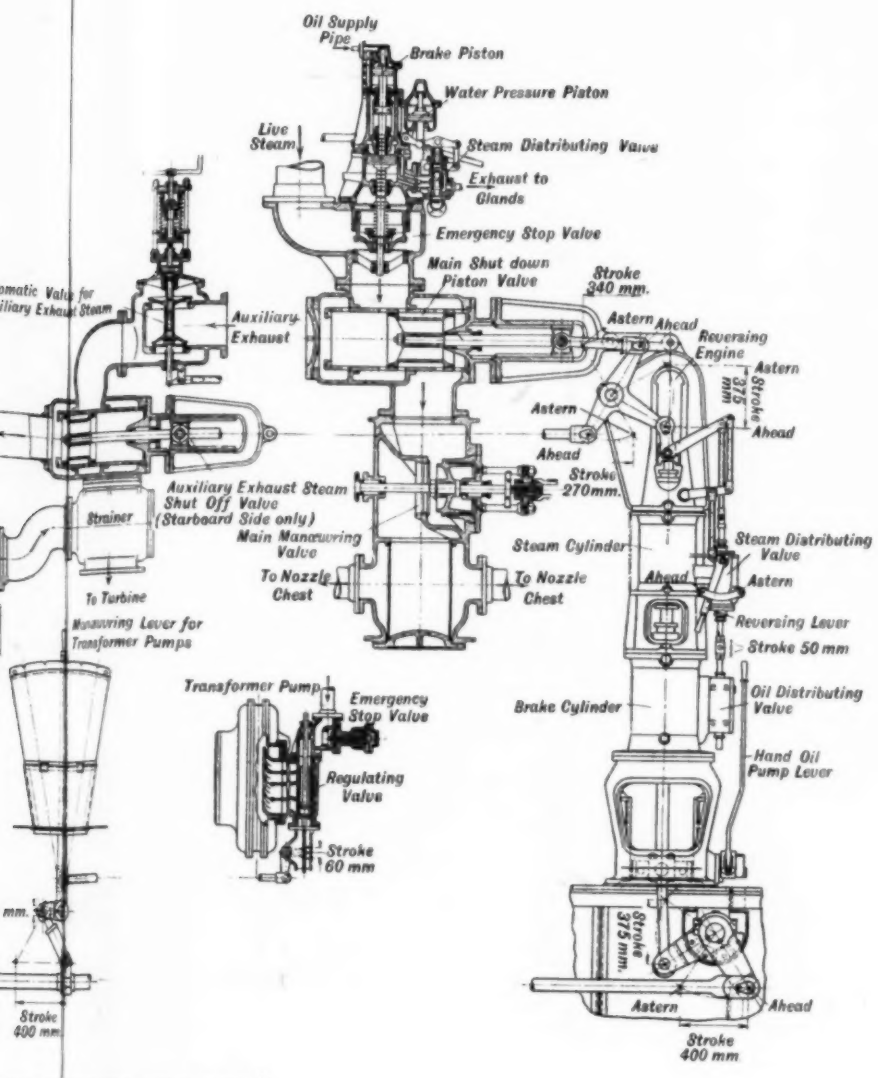
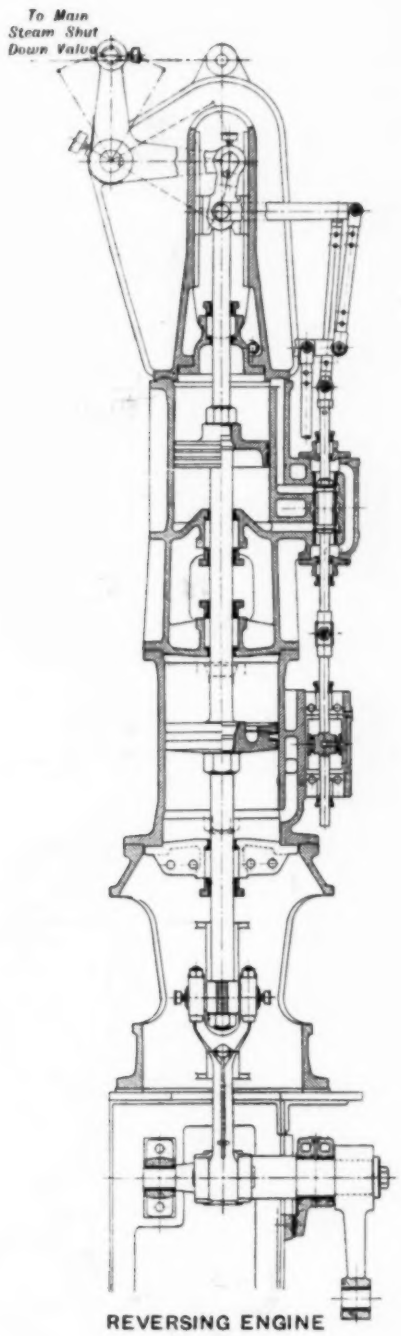


LONGITUDINAL SECTION THROUGH TRANSFORMER

EAR ON CANADIAN-PACIFIC STEAMER EMPRESS OF AUSTRALIA





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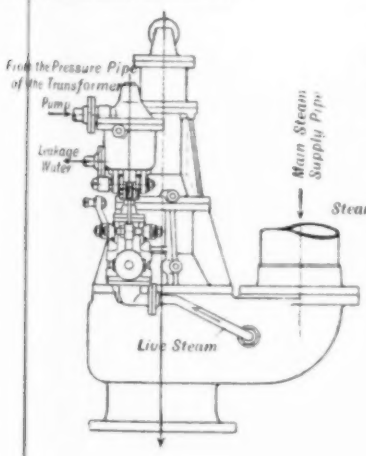

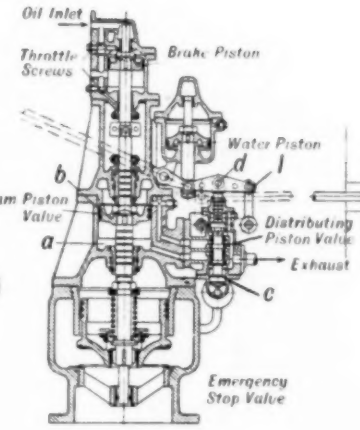

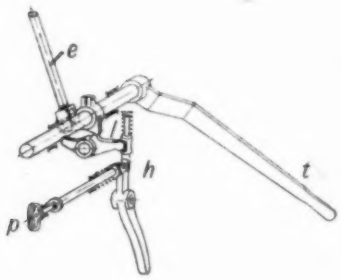

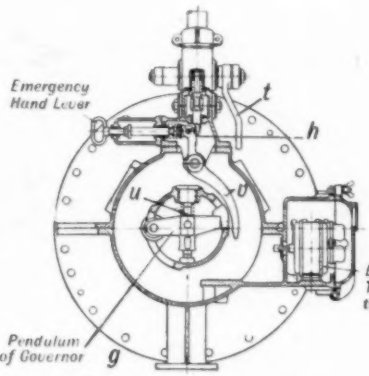

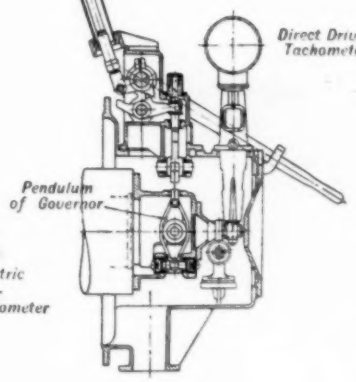

DETAILS OF EMERGENCY STOP GEAR

SWAIN Sc.

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Small Advertisements cannot be inserted unless delivered before TWO o'clock on Thursday afternoon (the day before publication). ALTERATIONS to STANDING ADVERTISEMENTS must arrive not later than THURSDAY of the week preceding publication.

Letters relating to Advertisements and the Publishing Department of the Paper are to be addressed to the Manager, all other letters to be addressed to the Editor of THE ENGINEER.

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PUBLISHER'S NOTICES.

*** *With this week's number is issued as a Supplement a Two-page Drawing of the Fosttinger Hydraulic Reversing and Reducing Gear on the Canadian-Pacific Liner Empress of Australia. Every number as issued by the Publisher contains a copy of this Supplement, and Subscribers are requested to notify the fact should they not receive it.*

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*** *All letters intended for insertion in* THE ENGINEER *or containing questions should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

*** *We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.*

By arrangement with Reuter's Engineering Service, The Engineer contains the latest news from all parts of the world which is likely to be of interest to engineers.

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TWO-PAGE SUPPLEMENT.—FÖTTINGER HYDRAULIC REVERSING AND REDUCING GEAR ON CANADIAN-PACIFIC STEAMER EMPRESS OF AUSTRALIA.

THE ENGINEER.

JULY 7, 1922.

Corrosion.

AT a meeting of the Royal Society last week Sir Robert Hadfield reached the astounding estimate that the total sum spent annually to counteract the ravages of corrosion is probably well over five hundred million pounds per year! It is impossible, obviously, to check that figure, and it is of small consequence whether it is a few millions too great or too small. It serves its purpose in directing attention to the cost to which the world is put by the slow decay of metals, and brings before us the fact that unless corrosion is checked, the known iron ore resources of the world must be exhausted within a measurable distance of time. Sir Robert quoted the opinion of Professor J. W. Gregory that if the output of iron should continue to increase at the rate that obtained before the war, then in no more than a century and a-half the world supplies would be exhausted. It is, we admit, a little bit difficult to be moved by the probable events of A.D. 2070. The everyday fact which we all have to face in a greater or less measure that pounds, shillings and pence have to be expended in the effort to preserve iron and steel parts from rusting by painting, and on the replacement of them when, despite all our care, they have been eaten away, is much more likely to bring home to us the serious nature of corrosion. On one important structure alone—the Forth Bridge—over ten thousand pounds were spent in the twelve months ending June, 1921, on painting and repairing. That structure weighs in round numbers 51,000 tons, so that something approaching four shillings per year has to be spent for every ton weight of the structure. If we take an annual world output of pig iron of, say, eighty million tons, and allow that on every ton, whether converted into steel or not, four shillings a year has to be spent on painting, we reach a total of sixteen million pounds per annum *on new constructions* alone. As hundreds of millions of tons of old structures have also to be preserved, the enormous cost involved may be imagined.

These figures, rough as they are, bring home to us the costliness of corrosion, and force us to recognise that amongst all researches in the scope of engineering, there is none that could do more to effect economy than the discovery of the means of arresting the decay of metals without the constant application of paints and protective coatings. The problem is an ancient one, and for many years past it has been attacked by researchers in all parts of the world. But even after prolonged scientific study and experimental inquiry, there is no unanimity of opinion as to the chemical reactions which takes place in the formation of rust. Whilst differences can exist about an elemental fact, it is almost hopeless to look for a scientific solution of the problem of corrosion, and we must hope rather to blunder upon it—if it is attainable—by the despised method of trial and error than by intelligent reasoning. We are indeed, as Sir Dugald Clerk said in a few brief remarks upon Sir Robert Hadfield's paper, obliged to follow the inductive method, piling up observations upon observations in the hope that some day useful deductions may be made from them. Unfortunately, the method is an extremely slow one. It would appear that corrosion is a very delicately balanced reaction, or system of reactions, for we know that a very small change in the conditions may have a marked effect upon the results. We are therefore without a standard by which to compare results. Iron that is almost pure resists corrosion, but so does iron or steel that contains a heavy percentage of chromium or nickel or a trace, one-quarter of one per cent., of copper. But even such irons and steels as these will not resist it in all cases, and whilst some do not corrode at all, others, by the corrosion itself, set up a protective mantle which inhibits further action. In the stainless steels—discovered *accidentally* by Mr. Harry Brearley—and in the more recent arrivals known as rustless iron, we have extremely useful materials which have proved their qualities in many and various conditions, but we hesitate, without further knowledge, to say that a bridge constructed of either material would give satisfactory results. The evidence indicates that it should do so, but, so variable and uncertain are the ways of corrosion, that until a bridge has been actually made and left, for long, exposed to the weather it is unsafe to speak definitely, and even after such a practical test we could not assert without reserve that a similar bridge erected in another place and faced by other conditions would show the same resistance. It is to be hoped, nevertheless, that the test will soon be made. The difficulty is not price alone. The anti-rusting properties of high chromium steels depend largely upon heat treatment, and in some measure upon surface conditions. Hence the material does not lend itself to the rough treatment of the bridge yard; but in view of the great economic importance of a satisfactory result, the adoption of special precautions and special methods would, we believe, be justified.

It is known to our readers that the Institution of Civil Engineers has set up a Committee for the study of the corrosion of steel in sea water, and that half the expense is being borne by the Department of Scientific Research. The Institution possesses unexcelled facilities for conducting an inquiry of the kind. It can send samples of steels to all parts of the world with the knowledge that they will receive the scientific attention of trained men, and it may therefore justly hope to secure a mass of statistics and information—an accumulation of inductive facts. But it is extremely unlikely that any single great generalisation will result from an investigation of the kind. So capricious apparently is corrosion, that we shall feel not the least surprise if a steel which gives admirable results in the Bristol Channel is far down the list of merit when tested in the Firth of Forth, or that a steel which fails hopelessly in, let us say, the Tyne, shows astonishing powers of resistance in the Hooghly. The fact is that after years of investigation, we are very little nearer understanding corrosion than we are of understanding cancer. Both appear to be capable of great divergences and to be subject to a variety of causes, and the best we can do is to keep on piling up observations in the hope that if they never lead to a great generalisation, they may at least serve as guides to the probabilities of similar cases.

Hardness.

HARDNESS is perhaps the most fundamental property of materials, and particularly of metals. None the less it is a property singularly difficult to define in precise terms, and concomitantly it has been found by no means easy to find simple, easy, and accurate means of measuring it. With regard to definition, one may perhaps accept the statement that hardness is the power of a material to resist the relative displacement of its parts. Put into more precise language, this may be expressed by saying that the hardness of a material is measured by the pressure in pounds or tons per unit area which, when applied over a limited portion of the surface area of the material, will just fail to produce permanent indentation. Hardness as thus defined is not precisely what is measured by the Brinell ball test. There an indentation is made and the metal undergoes local deformation and consequent hardening. None the less the Brinell test has proved extremely useful and gives indications of indisputable value. It begins to fail,

however, where very hard materials are concerned. In those cases the indenting ball itself becomes deformed. Some other method of measuring the highest range of hardness has therefore yet to be evolved, as neither the scleroscope nor the sclerometer really meets this need.

Whatever method of measurement be adopted or evolved, it yet remains necessary to correlate the "hardness number" with other properties of the metal and with its behaviour in service. Hardness is valued for a variety of purposes, of which we may take resistance to wear or abrasion and the power of maintaining a cutting edge as two typical examples. Now it does not follow that these two properties are at all closely related to one another, nor that either is proportional to the Brinell number or even to the "true hardness" which we have attempted to define above. The fact is that the behaviour of a metal when exposed to abrasion or used as a cutting edge depends entirely upon the arrangement within it of the minute particles which go to build up its microstructure. One arrangement may be exceptionally favourable for resisting the detachment of minute particles from the surface and yet not the best for resisting the entry of a ball pressed down by a heavy load. This fact may, perhaps, be made clearer by the aid of a simple analogy. A heap of loose sand would be extremely resistant to indentation by a large body. If one were flung violently against it, for example, he would have reason to regard it as distinctly "hard." Yet the abrasive action even of a baby's fingers is sufficient to remove it bit by bit. A pile of loose bricks behaves in much the same way, while a 4½in. brick wall set in cement would present great resistance to "abrasion" by piecemeal removal of the bricks, but it would present comparatively little resistance to pressure exerted by a large and heavy body. Translated into the minute scale of the microstructure of metals, corresponding differences exist, and it is by their study alone that we can hope to understand the causes and mechanism of the various kinds of hardness.

Particular interest attaches to the kind of hardness required for the maintenance of a cutting edge. In the keener cutting instruments, such as razors and the implements of the surgeon, there is still room and need for much improvement. The choice of a razor, even of the best-known makes, is admittedly a lottery, while safety razor blades vary immensely both in initial keenness and in durability. The variables of this problem are clearly not yet understood, and in need of further investigation. Of more importance from the engineering point of view are the cutting edges used in machine tools. Much study has been devoted to them and immense advances have been made in these days of tungsten steels capable of astonishing performances in high-speed cutting. That the subject is by no means exhausted is proved by the formation within the last few years, by the Institution of Mechanical Engineers, of a Cutting Tools Research Committee. Under the auspices of this Committee some fresh light has already been thrown on some of the general aspects of the problem, mainly by Professor Coker, with his optical methods, and by Colonel Crompton. The study of the problem of the relation of hardness to the behaviour of a cutting edge has, however, yet to be faced by the Committee.

The Institution of Naval Architects.

THE SUMMER MEETINGS IN PARIS.

No. I.

THE larger proportion of the members and guests attending the Paris meetings of the Institution of Naval Architects travelled from Victoria on the morning of the 3rd inst. *viâ* Folkestone and Boulogne, an excellent crossing being made on the South-Eastern and Chatham Railway Company's steamer Maid of Orleans, one of the many cross-Channel boats built by the famous Denny firm at its Dumbarton yard. Paris was reached shortly before 5 p.m. The opening meeting, which took place at 10 a.m. on Tuesday morning, and which was held in the Grand Amphitheatre of the Sorbonne, proved a very representative gathering of members and ladies, and a happy feature was the large attendance of French naval officers, engineers and shipbuilders, and the French contributions to the discussion on the two papers read.

In welcoming the Institution of Naval Architects to Paris, M. Bertin, President of the Académie des Sciences and President of the Association Technique Maritime, made reference to the scientific and mechanical progress of the eighteenth century and said that just as our ancestors regarded the frigate and the steamship as the ultimate triumph of human genius, so might the battleship and cruiser be regarded as the triumph of the twentieth century. The Sorbonne, he said, was founded in 1253 by Robert Sorbon, chaplain to the crusading Monarch King Louis IX. The room in which the conference was being held had historical associations, and the great thinkers of Europe had spoken on such different themes as Eternity, Platonism, and Human Origins in it. Sir William Thomson, afterwards Lord Kelvin, visited the University of Paris, and there met Regnault, who was at that time working on the theory of gases. The scientific collaboration of our two countries had helped to consolidate their sacred union, and if any cloud appeared it could only be a cirrus, which, as one well knew, served to portend good weather.

Replying on behalf of the Institution of Naval Architects, the Duke of Northumberland expressed the deep appreciation of the French invitation to hold the summer meetings in Paris, and thanked M. Bertin for his warm welcome and the excellent programme of entertainment and instruction which had been arranged. He recalled the visit of twenty-seven years ago, which had undoubtedly served to unify the two nations at a time when there was a tendency to pursue different policies. He regarded the present visit as a reaffirmation of the *entente cordiale*, and expressed the hope that such meetings would contribute to the future greatness and welfare of both countries.

The Chairman then called upon Sir Eustace d'Eyncourt (Vice-president), Director of Naval Construction, to read his paper on

"THE TENDENCY OF WARSHIP DESIGN AS AFFECTED BY THE WAR."

It is reprinted on page 18 of the present issue.

In the absence of the author, the Secretary, Mr. R. W. Dana, then read an abstract of a paper by Major L. Fea, of the Royal Italian Navy, on

"SOME OF THE CONSEQUENCES OF THE WASHINGTON CONFERENCE WITH REGARD TO NAVAL CONSTRUCTION,"

of which we append a *résumé*.

After outlining the restrictions imposed by the Washington Conference the author observes that the 35,000 tons maximum displacement allowed by the Conference is not sufficient if the problem of the present-day battleship is to be solved "without compromises." Is it possible to make better provision in view of possible progress of technical knowledge, or on the basis of acceptable modifications in the actual requirements of modern battleships? In order to arrive at a conclusion he then briefly examines the various requirements of the modern battleship, indicating some possible modifications. He concludes that it will not be possible to adopt guns of less than 16in. calibre, and he regards it as not impossible, especially in southern seas, that new means of fire control and spotting may enable the range to be still further increased, considerably beyond the horizon.

Discussing the minimum number of guns, he observes that there would seem to be a possible way of reducing the displacement of battleships in the near future, by building "super-rapid" gun mountings, which would require only ten seconds between each shot, and possibly even less. Naturally, a gun with "super-quick" firing would weigh considerably more than one of normal design, and therefore there follows the necessity of insisting on an increase in the number of guns of each turret, following the advice of the Italian Engineer Constructors Ferrati and Madsen.

Turning to secondary armament, the author remarks that it is necessary to have a single type of mounting, naval and anti-aircraft, in the guns of medium calibre up to 6in., thus uniting the anti-aircraft and anti-submarine guns. Designs on these lines are already well advanced, so that the problem may be considered as already nearly solved. But the actual number of guns in these batteries should be increased from the present twelve to sixteen, and, on the whole, rather than consider a reduction in the weight of secondary armament, we must frankly face a considerable increase. As to the use of larger ships as platforms for aircraft, the author says it would seem that this will have to be limited, at least for the present, to the smaller aeroplanes for reconnaissance and observing of shots, launched by means of catapults similar to those in use in the American Navy.

In conclusion, as regards offensive power, we may say that the only direction in which we can hope to effect the reduced displacement of future battleships is by a radical modification of the heavy artillery, which would allow of a diminution, to a certain extent, in their number. Reduction in the lesser armament and in under-water protection does not seem either possible or advisable.

On the subject of defence the author discusses side protection, deck protection, and under-water protection. For the side protection we must still have recourse to massive external defences. As a defence against 16in. shells, plates of equal thickness would probably be necessary, even at long ranges. But even by reducing the vertical protection to the indispensable minimum no great advantage as regards weight can be obtained. The utmost importance is given, and rightly, to the deck protection, as the horizontal target is by far the greater, not only in aerial attacks, but also against artillery at the actual ranges of battle.

Under-water defence is now of fundamental importance and is allied to the strength and stability of the ship. The three known fundamental solutions of the problem are:—The bulge system, proposed and experimented upon by General Ferrati in 1911, and largely used in the British Navy; the system of water-tight compartments, investigated in 1892 by the late General Benedetto Brin, which is largely used in the American Navy; and the system of "hydrodynamic action" of Colonel Pugliese. Other systems have been tried with success, but these three, which are based wholly or in part on metallic structures or large masses of liquid, are those which have the greatest probability of being retained in the future, as the weight of liquid fuel is not included in the "standard displacement" of Washington. Here we see that the Convention of Washington may have some curious results upon naval construction, almost as the tonnage rules have had upon mercantile naval construction.

A further system of defence will in future have to be provided, that is, against poisonous gas, whatever may be the consequence of the Washington Conference as to the abolition of this gas in future wars.

As regards the intrinsic qualities of the ship, advantages can only be obtained by means of steady and continual perfectioning of the design and material. These improvements might, amongst others, relate to:—

(1) The use of more perfect materials.

(2) The general use, if possible, of welding instead of riveting.

(3) The incorporation of the protective elements with the structural ones.

Concluding, the author says that the analysis which we have made regarding the various qualities, naval and technical, of the modern battleship does not leave us any illusions as regards the impossibility of being able to comprise within the limits of displacement fixed by Washington all the offensive and defensive power which at the present day would seem desirable. It would be well to note that, whatever may be the road which it will be necessary to follow in order to gain this object, two conditions must be observed: a systematic and profound study of all the material which is necessary for the construction of such a complex machine as the modern warship; and very great expense, which may cause one to doubt whether the ship of the future of 35,000 tons imposed by the Washington Conference will really cost the various Governments much less than the present-day ship of 40,000 tons.

The discussion on both papers was opened by Admiral Le Bon, who, on behalf of the Ministry of Marine, welcomed the Institution, and expressed interest in its work. Never before was the question of naval architecture and marine engineering so complicated, and the Washington Conference testified to that fact. We had seen the most distinguished men of the world meet to arrange a peace which would be unbroken. But the task of the naval architect was to work as ever on the production of weapons which we were not certain we should need. Major Fea had clearly described the difficulties confronting us. All the qualities of the fighting ship had to be maintained, but by limiting the displacements we were, if he might so say, tied up by the arms and legs. The solution of the problem of the fighting ship appeared to be almost impossible, but the skill of our naval architects and engineers would, he felt sure, overcome the difficulty. An important question was the development of the new arms which had proved effective in the war, but there, again, barriers were met with.

M. Doyère, Director of Naval Construction of the Ministry of Marine, said as a naval constructor he welcomed the Washington agreement, which had showed the world what were the real difficulties of engineers and constructors. Limitation was not a new problem, and displacement had always been controlled. In 1912 French designs of fighting ships were limited to 25,000, 27,000, and 28,000 tons by slipways and dry docks. With the new limit of 35,000 tons he was sure that problem might be solved. Lines of development might be found in the reduction of machinery weights, and a better ship form. The question of under-water protection was an old one, and M. Bertin had done much on the subject. With regard to the aeroplane carrier, he asked if that type of ship would survive as the aeroplane became larger?

Sir John Biles remarked on the complementary character of the two papers which had been read, one of which had sought to describe what had to be done, and the other how to do it. It appeared as if, in the immediate future at any rate, battles would again be fought on paper and not at sea, and there was room and a great deal of scope for friendly rivalry between naval constructors and engineers. Accepting the Washington limitation, he thought that it was rather a problem of new patterns and designs of ships than of solving the problem of the best ship. The work done during peace—the time of limited spending—could then be drawn upon if war—the time of unlimited spending—evere ame again.

Vice-Admiral Fournier, Académie des Sciences, said he regarded the form of ship for the maximum speed as of supreme importance, and referred to the lesson to be drawn from experiments on models in Paris. Speed was shown to be an important factor in the war both for naval tactics and for escaping submarine attack. The form to give the best speed was also important for mercantile construction, which in the future would no doubt occupy a prominent place.

General Rota discussed the question of submarine attack and the relative importance of vertical and deck protection. He spoke of the excellent work of the motor boat during the war, and it was his opinion that such craft would remain relatively small in size.

Captain F. Clifton Brown, R.N., speaking from the point of view of the naval officer, said the limitations of the Washington Treaty with regard to the size of ship were welcome, because with the increasing size of ship the difficulties of harbour accommodation increased. The problem would be to work out the possibilities of the limited size. An important point was the steadiness of the gun platforms, and together with the improvements in automatic sights and automatic firing, there was much interesting work to be done. He thought some economy might be made by reducing the under-water torpedo service. Speed was the most important factor, and speeds of 25 knots for the biggest ships, and 30 knots for battle-cruisers, would no doubt be retained.

Sir Eustace d'Eyncourt, in replying to the discussion, regretted the absence of Major Fea. He referred briefly to points raised by the different speakers, and particularly to the contributions made by the distinguished French naval officers and constructors who had spoken. During the war the French Government had entrusted the British naval authorities with the building of six or eight sloops of the "Aldebaran-Argol" class. It had been a pleasure and pride to execute these orders. He did not regard welding as yet practicable for general application to naval work.

Water Power in the Canadian Pulp and Paper Industry.

THE Dominion Water Power Branch of the Canadian Department of the Interior has recently issued an interesting memorandum on the subject of the part which water power plays in the country's wood pulp and paper industry. As is well known, the manufacture of pulp and paper is one of Canada's outstanding industries. According to the Bureau of Statistics figures for 1920, the industry represented a total capital investment of 347,553,333 dols.—roughly £69,500,000; found employment for 31,298 persons whose yearly wages and salaries amounted to 45,253,893 dols.—say, £9,000,000; while the value of the products totalled 214,421,546 dols.—or over £42,800,000. The export trade, which was only worth £24 in 1890 for this industry, is often contrasted with the present corresponding figure of over £20,000,000 to demonstrate the remarkable expansion during this period.

IMPORTANCE OF CHEAP POWER.

The question of motive power in connection with the production of pulp and paper is a most vital one and, in fact, is almost as important as that of raw material. In any industry the relative necessity of obtaining cheap and adequate power may be gauged by the amount required per dollar of product, and, with the possible exception of certain electro-chemical and metallurgical processes, the requirements for pulp and paper are among the highest. The importance of cheap power may be judged from the fact that it takes practically 100 continuous horse-power to make a ton of paper per day. It is, therefore, little surprising that motive power used in this industry is practically restricted to hydraulic energy, and Canada's position in the pulp and paper field rests on adequate and abundant water powers well distributed among extensive forest resources.

Average figures in connection with a large Canadian mill show that mechanical pulp requires 73 horse-power per ton of daily output, of which 67 horse-power is for grinding alone; sulphite pulp requires 8.7 horse-power per ton of daily output, and in other large mills as high as from 20 to 30 horse-power; while the production of newsprint from pulp consumes 12 horse-power for the same unit output. The continuous operation of mills in this industry, usually twenty-four hours per day, permits a very advantageous use of the necessary power, and with direct water power or hydro-electric energy further allows a cheap unit cost for the amount consumed. For instance, one of the Canadian sulphite mills, with an installation of 1500 horse-power, purchases hydro-electric energy on the basis of 1 dol. per horse-power per month plus a consumption charge on a sliding scale, and it was found that the minimum rate of 0.1 cent per kilowatt-hour could be taken advantage of for about 75 per cent. of the total consumption, thus reducing the unit power cost very materially.

WATER-POWER INSTALLATIONS FOR PULP AND PAPER INDUSTRY.

In view of the prominent place which the pulp and paper industry has acquired in Canada, and conscious of the important part which the country's water-power resources are playing in the development of this field, the Dominion Water Power Branch recently undertook a special study in this connection, and has gathered much information on power installation and requirements at pulp and paper mills operated by water power or by purchased hydro-electric energy. For the sake of brevity the general term "pulp and paper mills" has been adopted throughout this review as including pulp mills, pulp and paper mills, and paper mills. It appears that the water-power installations for the operation of pulp and paper mills in Canada aggregates 476,503 horse-power, while the additional hydro-electric energy purchased for this industry is 160,577 horse-power, giving a total of 637,080 horse-power. This covers the energy derived directly or indirectly from water power, but does not include mills in which steam only is used as motive power. The use of steam as a source of power in the industry is very limited, and in most cases is prompted by special conditions such as operation in close connection with the manufacture of lumber when refuse from the latter can be used as fuel under the boilers. The census returns for 1920 showed a total steam-power installation in pulp and paper mills in the Dominion of only 62,400 horse-power, and if the capacity of the three or four larger steam-operated mills in which special conditions obtain be excluded, the remaining unit capacity works out to a very small figure.

Of the total water-power installation for the various mills a total of 178,911 horse-power is converted into electrical energy before it is used to operate the pulp and paper machinery. The advantages of electric drive are numerous; a uniform speed is assured, which is of primary importance in governing the quality of the product; it also allows of the centralised operation of a large mill receiving power from several hydro-electric sources while with it a closer study of power conditions, adjustment, and consumption is possible. A well-known authority on pulp and paper mill operation in Canada recently stated that the proper way to build a paper mill was to develop the power as a hydro-electric project and build the mill at a place most suitable from the operating and shipping point of view, adding that the time for direct connecting of turbines to grinders was past.

WATER-POWER INSTALLATION AT EACH MILL.

The memorandum is accompanied by a series of tables which are too extensive to be reproduced here. We may say, however, that Table No. 1 presents a complete list of pulp and paper mills in Canada which are operated by water power, and shows the principal features in connection with the motive power installation. Other information given includes the name of the river from which power is obtained; the head of water utilised in the development; and the number of turbine units installed to operate the mill and their total capacity. It is pointed out that numbers of mills, while producing their own power, convert the whole or a portion of the latter to hydro-electric energy before using it throughout the mill, and that as that is an important feature in modern operation, the mills where such conditions exist are specially indicated. There are numbers of cases in which the hydro-electric power used at the mill is generated quite a distance from it. In most instances, the pulp and paper mill is installed at a water-power site, and when gradual expansion has necessitated additional motive power, another near-by hydraulic site has been developed and hydro-electric energy transmitted to the mill to permit centralised operation. In the Lake St. John district in Quebec Province one of the large mills receives energy from two hydro-electric plants situated a few miles away and operated by the same company in addition to the water power developed at the mill itself. Beyond the power produced for the particular purpose of operating the mill, many pulp and paper organisations in Ontario and Quebec also purchase hydro-electric energy from outside sources.

MILLS OPERATED FROM PURCHASED ENERGY.

Table No. 2 gives a list of mills operated entirely from purchased hydro-electric energy. In this connection it is mentioned that a few of the mills given as purchasing power could practically be said to produce their own hydro-electric energy in cases in which the power plant is almost exclusively used to supply the pulp and paper mill, but is operated by a subsidiary or allied organisation. On the other hand, large power organisations supply a considerable amount of power to the pulp and paper industry. In Quebec the Shawinigan Water and Power Company and its allied organisations supply some 80,000 horse-power, while in Ontario, the Hydro-Electric Power Commission and Toronto Power Company together supply some 55,000 horse-power for that purpose.

CHARACTERISTICS OF GEOGRAPHIC GROUPS.

The distribution of the pulp and paper mills in Canada shows that they are grouped according to facilities for wood, power or transportation. The various mills of the same group show certain outstanding features with regard to power requirements as a result of the class of production which characterises the group. Table No. 3 illustrates the predominating features in certain districts into which Canadian mills may be arbitrarily grouped. Perhaps the greatest contrast exhibited in this table is between the class of mills found in the Niagara and Toronto, Eastern Ontario, Montreal and Quebec city groups, in which a large number of mills, the average capacity of which is small, produce much of the miscellaneous kinds of paper, while the British Columbia and more northerly groups in Ontario and Quebec which comprise mills of large capacity, requiring much power, produce principally pulp and newsprint.

MOTIVE POWER BY PROVINCES.

The mode of producing power for the operation of pulp and paper mills is summarised in Table No. 4. While there is still a large amount of water power used to drive the mill equipment directly from turbines, a considerable portion is utilised by first converting it to hydro-electric energy for the more convenient electric motor drive. An examination of the figures given shows (*a*) that the two modes of operation are fairly evenly divided in British Columbia and Quebec; (*b*) that electric drive predominates in Ontario and New Brunswick; while (*c*) direct water-power drive is used almost entirely in Nova Scotia. An inspection of the data in the various tables shows the province of Quebec slightly ahead of Ontario in the pulp and paper industry. British Columbia ranks next, followed by New Brunswick and Nova Scotia, while this industry has yet to be introduced in the prairie provinces.

QUEBEC.

This province has fifty-four mills requiring a total of 312,867 horse-power either installed or purchased. The total daily producing capacity of these mills is some 3000 tons of mechanical pulp, 1500 tons of chemical pulp, 1300 tons of newsprint, and 700 tons of other kinds of paper. There are naturally several large mills in this province in which much energy is purchased or extensive water-power installations are required. The three largest are:—(*a*) At Grand 'mere, where all the hydro-electric energy is purchased; (*b*) at Kenogami, where power is obtained from two hydro-electric plants in addition to that produced at the mill; (*c*) at Shawinigan, where a portion o the power is purchased. Each of these mills requires some 25,000 horse-power or more. Other large mills requiring between 10,000 and 25,000 horse-power include those at Hull, East Angus, Brompton, Chicoutimi, Clark City, and Cap Magdelaine.

ONTARIO.

Ontario has forty-one mills where the installed or purchased power aggregates 242,746 horse-power. These mills have a total daily producing capacity of some 2000 tons of mechanical pulp, 1100 tons of chemical pulp, 1800 tons of newsprint, and 600 tons of other kinds of paper. The feature in this province is the Iroquois Falls mill, requiring 52,000 horse-power, including the energy transmitted from Twin Falls. Another large mill, with an installation of 28,789 horse-power, is situated at Ottawa. Mills requiring between 10,000 and 20,000 horse-power are numerous, and include those at Sault Ste. Marie, Espanola, Sturgeon Falls, Thorold, Fort Frances and Fort William.

BRITISH COLUMBIA.

British Columbia has only five mills operated by water power, but they are all of fair size, and require a total installation of 48,800 horse-power, while their daily producing capacity is 390 tons of mechanical and 345 tons of chemical pulp, 445 tons of newsprint, and 30 tons of other kinds of paper. The two large mills at Powell River and Ocean Falls have respective installations of 24,000 horse-power and 20,550 horse-power.

NEW BRUNSWICK.

This province only has three mills operated by water power, with a total installation of 14,668 horse-power and a daily producing capacity of 30 tons of mechanical and 250 tons of chemical pulp.

NOVA SCOTIA.

There are ten mills operated by water power in this province, but most of them are not large; their total installation aggregates 17,999 horse-power, and their daily producing capacity is some 230 tons of mechanical pulp.

FUTURE POWER REQUIREMENTS OF INDUSTRY.

A few words may be added regarding the future trend of the pulp and paper industry which should be of particular interest from a water-power point of view. Owing to the present financial depression no very great expansion need be looked for immediately. A very realistic illustration of what may be expected when industrial conditions become normal was afforded by the pulp and paper boom of 1918 and 1919. A large number of projected undertakings were then investigated, and many requests for information were received by Dominion Government organisations in possession of the desired data, as in most cases the parties concerned did not care in what province the mills were to be established. It was a case of obtaining pulp wood and water power almost at any cost and anywhere within reason. While most of these projects did not materialise owing to subsequent financial and other conditions, they revealed what conditions may be expected in the future development of the industry and demonstrated what an important part the northern water powers of Canada will be called upon to assume in this connection.

It has recently been estimated that the present pulp wood demands on Canadian forests consume some 20,000 acres per year, and following the trend of other commodities this consumption will most probably assume a rapidly increasing rate. While the re-forestation methods now being extensively introduced will later on help to remedy this depletion, it must be noted that a period of from 50 to 100 years is required for suitable growth, and until full results are realised it will doubtless be necessary to extend wood pulp operations farther and farther north, and the bountiful supply of water power which exists in those regions will in no small degree facilitate the fullest development of this industry. Pulp wood and water power are the chief factors in connection with future expansion, and the accompanying table shows side by side the proportion of these resources available in each province of the Dominion.

Available Pulp Wood and Water Power of Canada.

Province.	Estimated pulp wood resources million cords.	Available water power at ordinary minimum flow, H.P.
British Columbia	285	1,931,142
Prairie Provinces	185	4,259,253
Ontario	200	4,950,300
Quebec	300	6,915,244
New Brunswick	33	50,406
Nova Scotia	30	20,751

THE late fishery protection cruiser Hearty, now renamed the Dalhousie and recently refitted at the Tees yard of Smith's Dry Dock Company for the Ocean Salvage Company's fleet, is probably the most completely equipped salvage vessel afloat. With a gross tonnage of 785 tons, her engines are capable of developing 2400 horse-power and her towing gear can withstand a pull of 200 tons, while her navigating, lighting and wireless equipment includes all the newest devices.

The Re-Signalling of the Mersey Railway.

THE terminus in Liverpool of the Mersey Railway is under the Central Station, and from it to Hamilton-square Station, Birkenhead, is 1 mile 65 chains. There the railway divides, one portion going south to Rock Ferry, 3 miles 46 chains from Liverpool Central, and the other going north-west to Birkenhead Park, 3 miles 15 chains from Liverpool Central. Between Liverpool Central and Hamilton-square there is an intermediate station—James-street—which is on the Liverpool side, and from that station to Hamilton-square is a distance of 1 mile 14 chains. It is within this section that the line passes under the river Mersey by gradients seen in Fig. 1.

To this railway belongs the credit of being the first in this country to be converted from steam operation to electric traction. The change was made in May, 1903. In 1902, the last complete year of steam working, the number of passengers that passed through the river section was 6,850,000. During the same year the passengers by the ferries numbered 12,020,000. The better general conditions given under electrification may be judged by the fact that for 1912 the corresponding figures were 15,819,000 and 10,173,000 respectively. The increase in the traffic of the Mersey Railway as a whole since the conversion is reflected in Fig. 5. Figures subsequent to 1913 are not available, as the Clearing House divisions ceased when the war broke out, and so no record is available as to the number of passengers booked to the Mersey by other railways. It is, however, estimated that the 15 millions of 1912 have now reached 18 millions a year.

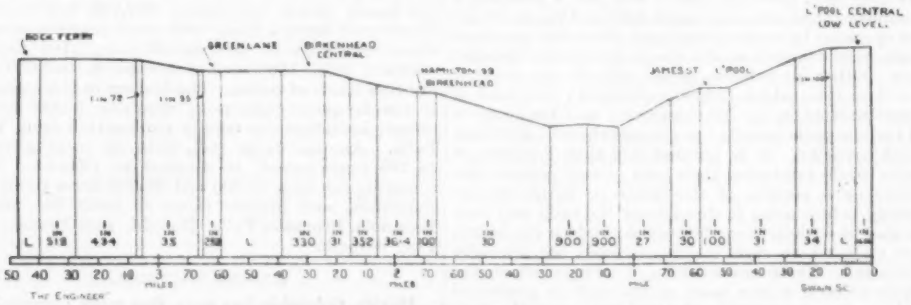

ROCK FERRY
GREEN LANE
BIRKENHEAD CENTRAL
HAMILTON SQ BIRKENHEAD
JAMES ST L'POOL
L'POOL CENTRAL LOW LEVEL
50 40 30 20 10 3 MILES 70 60 50 40 30 70 10 2 MILES 70 60 50 40 30 20 10 1 MILE 70 60 50 40 30 20 10 0
THE ENGINEER
SWAIN Sc.

FIG. 1—PROFILE OF THE LINE BETWEEN ROCK FERRY AND LIVERPOOL CENTRAL

This remarkable growth in its traffic placed a great strain on the carrying capacity of the Mersey Railway, limited, as it was, by the river section, which, with mechanical signalling, could not be divided. The general manager, Mr. Joshua Shaw, appreciated that automatic signalling, such as that to be found on the London Underground railways, and, possibly, on the East London Railway in particular, would solve his difficulties, and, after investigation, the directors placed a contract with the firm which carried out the signal installations in London—the McKenzie, Holland and Westinghouse Power Signal Company, now associated with the Westinghouse Brake and Saxby Signal Company, Limited, of 82, York-road, King's Cross, N. 1—to provide automatic signalling between Liverpool Central and Hamilton-square stations, the effect of which would allow the number of block signals sections between the stations named to be increased from two to four.

OVERLAPS.

It goes without saying that the greater the number of sections in a length of railway the greater the number of trains that can pass over that length in a given time. The number of sections is determined by the time it takes a train to pass through them, and this, in turn, is governed by gradients and station stops. In the Mersey installation the severe gradients approaching the centre of the river section were a most important factor in the matter of speed. They also more than usually affected what is known as the "overlap," or extra length provided as an overrun in which a train would be automatically pulled up by the train stop in case a driver should inadvertently pass a signal at "danger." In automatic signalling a signal cannot be lowered unless the section immediately in front of it and the overlap at the further end of that section are both clear. The less in length these overlaps are the nearer naturally may the signals be placed. In order to ascertain what lengths might safely be given, exhaustive tests were made by Mr. Shaw, and the signals were fixed in positions to suit, a factor of safety being added to the braking distance in deciding the length of the overlap.

THE SIGNAL LAY-OUT.

The scheme as carried out provides for five sections on the down line, the signals being placed as shown in Fig. 2, and the track circuit divisions being shown by the cuts in the lines. On the down road the automatic signalling begins at signal B 7, and on the up road at signal D 17. There is an emergency cross-over road at James-street, which is worked by No. 6 lever in the signal-box there. This box—Fig. 3—is normally closed, but should emergencies arise that lead to the cross-over being used, the signalman would restore levers Nos. 3, 4, and 8—shown reversed in Fig. 3—which would hold signals C 3, C 4, and C 8 at "danger" and allow the cross-over to be used. There are four purely automatic signals—S 2, S 5, S 1, and the repeater RC 3 for C 3—and nine semi-automatic, *i.e.*, automatic, but subject to control from signal-boxes—B 7, C 3, C 4, C 11, D 2, D 17, C 8, B 19, B 22. An illuminated diagram in the Central box indicates the position

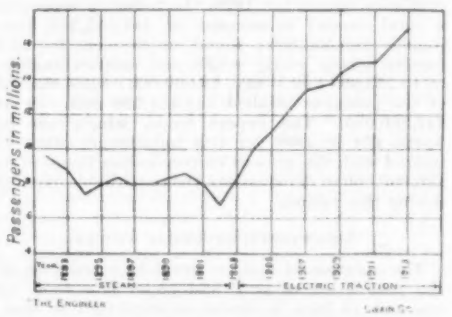


FIG. 5—CURVE SHOWING INCREASE IN PASSENGERS

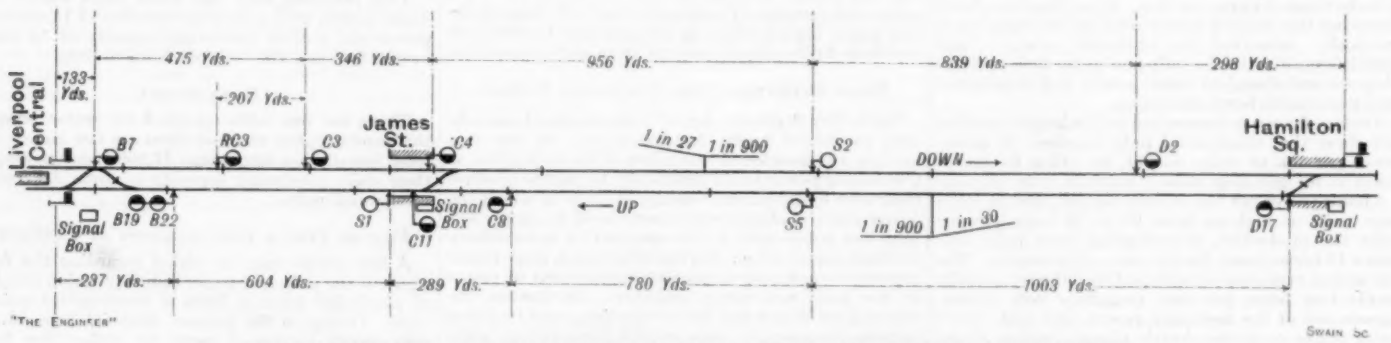


FIG. 2—ARRANGEMENT OF SIGNALS BETWEEN LIVERPOOL CENTRAL AND HAMILTON SQUARE STATIONS

FIG. 3—INTERIOR OF JAMES-STREET SIGNAL BOX

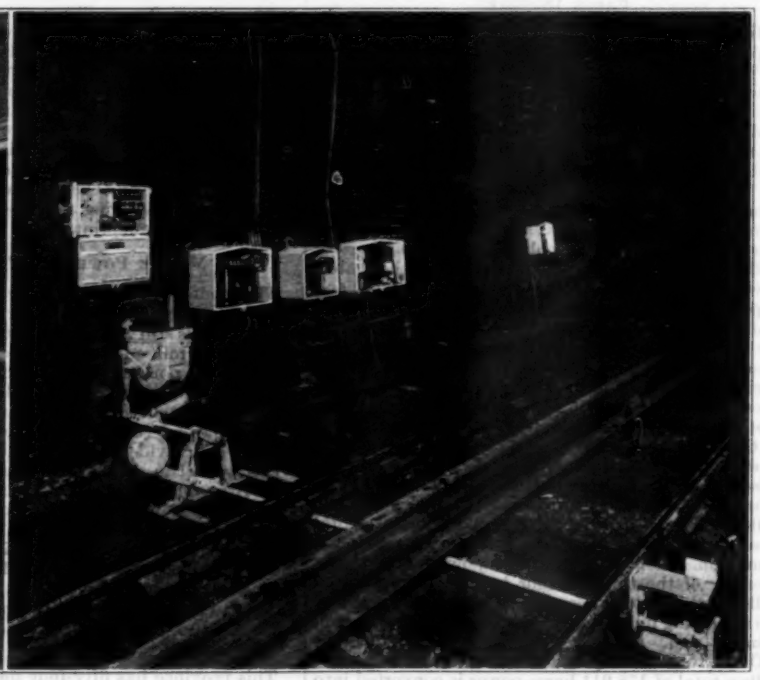


FIG. 4—SIGNAL, AUTOMATIC TRAIN STOP, TRACK AND LINE RELAYS

of all tracks at and between Central and James-street stations. One in James-street box indicates the tracks between Central Station and signal S 2 on the down line and between signal S 5 and the overlap for signal S 1 on the up line. In Hamilton-square box is an illuminated diagram of the tracks there and up to James-street. The semi-automatic signals are electrically repeated into the boxes whence they are controlled. A current transformer

is in series with the red lamps. It has a primary of low impedance, and when current passes through the red lamps the repeater lamp in the signal-box is illuminated, voltage, and the rear, or reserve, lamp is intended of a higher voltage. It is normally underrun, but should the front lamp burn out, would increase automatically to an

On reference to Fig. 6 it will be noted that the low voltage not only supplies, through a resistance, current to the two red lamps, but also to one winding of the flux

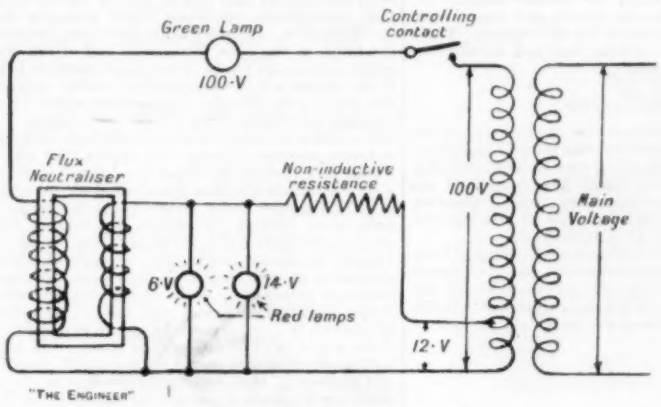


FIG. 6—CONNECTIONS FOR SIGNAL LAMPS

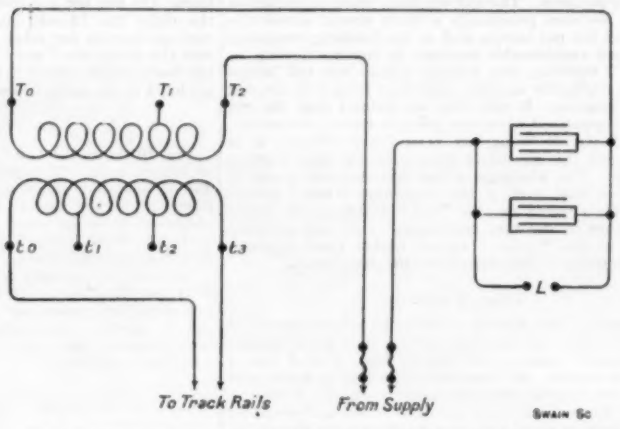


FIG. 7—CONNECTIONS FOR CONDENSER-FEED TRACK CIRCUIT SYSTEM

This proves the illumination of the red lamp in the signal, and is known as a proving transformer.

THE SIGNALS.

Colour light signals, of the flux neutraliser type, are amount sufficient to show a good red light. The source of supply for the signal consists of a transformer with primary winding 550/600 volts and two separate secondaries, 100 volt, with tappings 10/12 volt, and 6 volt. The neutraliser. The latter is the equivalent of a transformer, and is connected in parallel with the lamps. The controlling contact is opened and closed by the track relay, and when the track circuit concerned is unoccupied the controlling contact is closed and the "green," or high-voltage, current passes through the green lamp and, in series, through

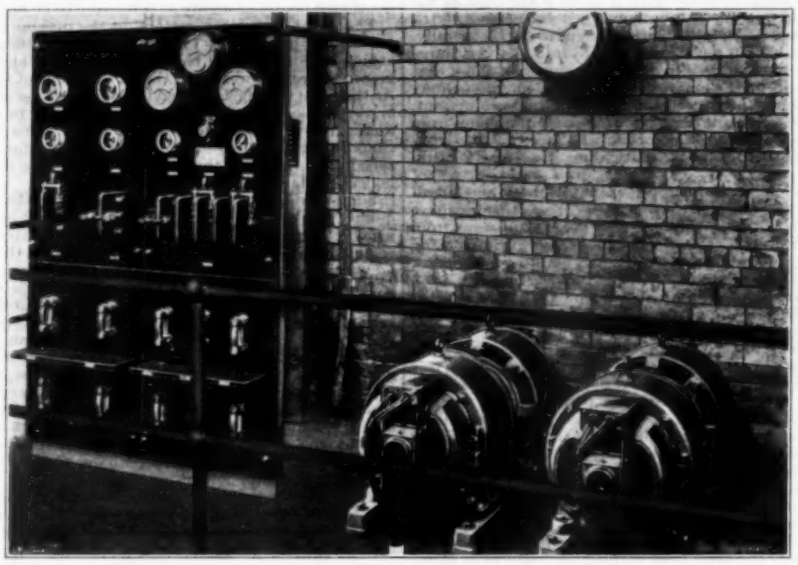


FIG. 8—MOTOR-GENERATOR SETS AND SWITCHBOARD

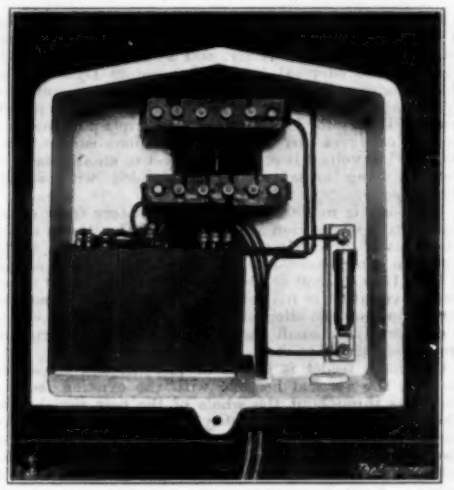


FIG. 11—TRANSFORMER FOR CONDENSER-FEED CIRCUIT

used, having an upper red—yellow for the repeater signal —and lower green lens, and no moving parts. One such signal is seen, with the cover opened and the interior former is for the "green" circuit of the signal, the train stop, the two-element vane relay local circuit, and the primary of the condenser feed track service set. The another winding of the flux neutraliser to the return.

When the "green" circuit is open, current flowing through the "red" winding of the flux neutraliser creates a magnetic flux in the iron core which, in turn, results in the winding having considerable impedance. When, however, the "green" is closed and current flows also

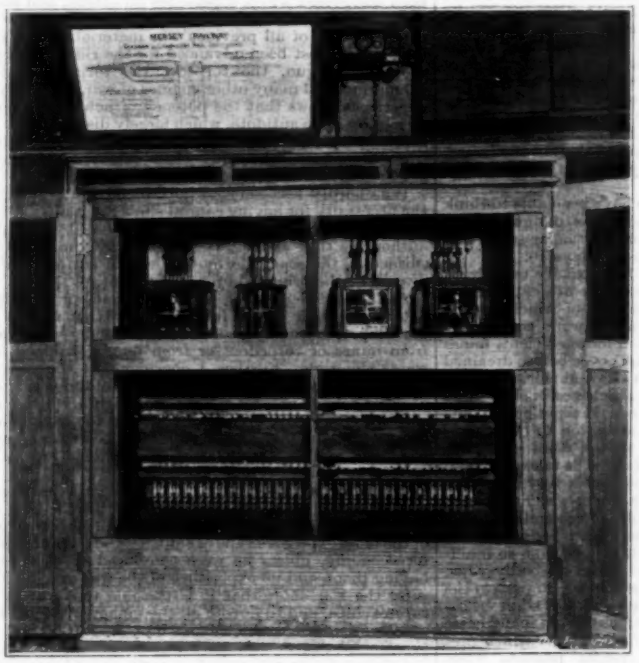


FIG. 9—CABINET FOR RELAYS AND FUSES, JAMES-STREET STATION

FIG. 10—TRAIN INDICATOR, JAMES-STREET STATION

exposed, on the extreme left in Fig. 4. The red light is in duplicate, one lamp behind the other. The front, or focal, lamp is supplied with current at approximately normal 10/12 volt tappings are for the "red" circuit, and the 6-volt winding is used to feed the track circuits when resistance feed methods are employed. through the "green" winding of the flux neutraliser, the latter is so connected and proportioned that the flux created in the iron core is equal and opposite to that

created by the "red" winding. The two windings, therefore, neutralise each other, with the result that when both circuits are closed there is no magnetic flux in the core, and therefore neither of the windings has any considerable impedance. The red winding, being of negligible resistance, becomes practically a short circuit across the terminals of the red lamps, and as the limiting resistance prevents any considerable increase in current flowing to the "red" winding, the voltage across the red lamps drops to a negligible amount, and thus results in the red light disappearing. It will thus be realised that the red lamps are suppressed when the green is alight. Moreover, the "red" circuit being fed at a lower voltage, it is impossible for this circuit to illuminate the high voltage green lamp. The windings of the flux neutraliser are so proportioned that even if the maximum "red" circuit voltage were applied to the "red" winding the transformer action of the flux neutraliser could not produce a voltage in the "green" circuit higher than approximately one-third of the voltage for the green lamp.

TRAIN STOPS.

The signals on the Mersey Railway have been provided with a train stop for over ten years. It is fixed outside the right-hand running rail—as in Fig. 4—and has a vertical movement. As illustrated, the stop is down, and will clear the tripping apparatus on the train. Were the signal at "danger" the stop would be raised and would be struck by the trip, should the motorman overrun the signal, so that the train would be automatically pulled up. The lowering of the stop is done by one of the contractor's type G signal machines—seen with the cover removed—with a bracket and crank movement. The stop has a counterbalance weight which ensures that the stop would rise should any of the connections break. Owing to the presence of pipes the usual fixing could not be adopted, hence the arrangement seen is not ideal.

POWER SUPPLY.

Direct current being used for traction, the signalling is effected by alternating current. Two motor alternator sets, each of 5 kVA capacity, and a signal switchboard—Fig. 8—were supplied by the Lancashire Dynamo and Motor Company, Limited—as sub-contractors—and fixed by the signal contractors in the railway company's power-house. The motor is a shunt-wound triple-pole machine running off direct-current supply which may vary between 500 and 700 volts. It is coupled direct to an alternator of the revolving armature type, provided with special windings.

Provision is made to operate the motors from either the lighting or traction switchboards. The design of the whole set is such that the maximum variation in speed, with the direct-current voltage variation quoted above, is from 1490 to 1550 revolutions per minute, which represents a variation in frequency of 49.6 to 51.6. The 600-volt supply on the alternating-current side is kept within a comparatively small margin, although the alternators are not separately excited.

One main feeder is in use at present, and is carried through the vertical heading with the existing feeders, and runs throughout the whole of the new signal area. This 600-volt single-phase 50-cycle signal supply is transmitted to transformers fixed at intervals to the walls of the tunnel, and is transformed down to the necessary voltage for operating the signals, train stops and track relays. Each transformer has one primary winding 550/600 volt and two separate secondary windings 100 volts with tappings 12/10 volt, and 6 volts.

TRACK CIRCUITS.

The track relays themselves are of the well-known two-element vane type, and are provided with two windings, local and track. The local winding is constantly energised at 100 volts, and the track element, operating at a low voltage, depends on the conditions of the track circuits for its energy. These relays are of the latest type and incapable of operation by direct current. It has generally been the practice of the contractors to supply a resistance or impedance, in series with the track transformer, in order to limit the short-circuit current to the track circuit when a relay is shunted. The conditions prevailing here were such, however, that this course in many cases was impossible. Naturally, an amount of salt water from the river above had percolated through the ballast, which reduced the insulation resistance of the ballast to an almost negligible amount, so much so that special means of feeding the track circuits were necessary.

To overcome this difficulty the contractors installed their patented condenser feed track circuit system—Fig. 7. This type of track circuit requires a special transformer—Fig. 11—with a primary winding fed from the 100-volt mains through an adjustable condenser, and a secondary winding connected direct to the track rails. Regulation is effected by means of tappings on the transformer windings, and also by varying the capacity of the condenser, the latter being adjustable for this purpose. By using the tappings on the transformer windings the phase angle can be adjusted either to lead or lag as desired. This system is very economical, the watts taken for the track circuit with a train in section being less than are taken with a clear track.

An idea of the low ballast resistance obtaining may be gathered from the fact that on a short track, 367ft. in length, the ballast resistance was only 0.105 ohms. We do not know of any track circuits having such a low ballast resistance; probably there are none in existence working under such difficult conditions.

All this equipment, seen in Fig. 4, is kept in cast iron cases, and therefore free from the ill-effects of the atmosphere of the tunnel.

CABLES AND TRANSFORMERS.

The same illustration shows the main feeder and various signal cables suspended from the existing cable brackets—Fig. 4. The signal cables are lead covered and paper insulated, the wiring of the signal apparatus being lead-covered V.I.R. cables. The connections to the track rails are of double-braided, taped and compounded gutta percha cables. Where it is necessary to cross the tracks, cables are run in pipes buried beneath the ballast.

Fig. 9 is an illustration of the cabinet in James-street box containing the controlling relays for tracks in the vicinity. In the bottom compartment are situated the control fuses which are fitted on all outgoing and incoming lines. On the left are seen the 100-volt bus-bars, and on the right the 12-volt bus-bars, the former feeding the various circuits for relay locals, signals and train stops, and the latter the "red" circuits for the signals. These bus-bars are energised from a main fuse and transformer set fixed in the cabin basement.

TRAIN INDICATORS.

Fig. 10 shows the train indicator on the down platform at James-street. It was made by the railway company, and is operated by an alternating-current contact relay energised by the passage of a train. This relay is of the single-coil type in which contact arms, when operated, make alternate contact to one or other of two circuits, illuminating either the upper or middle arrow.

Between the opening of this system on November 13th, 1921, and May 31st, 1922, there were five failures of signals out of 835,901 movements—all such failures being on the side of safety; no failures of train stops out of 455,946 movements; and no failures of track relays out of 1,671,802 movements.

The Tendency of Warship Design as Affected by the War.

By Sir EUSTACE T. D'EYNCOURT, K.C.B., D.Sc., F.R.S.,
Vice-president, Director of Naval Construction.*

THIS summer meeting, taking place, as it is, in Paris, appears to demand more than is usually the case at the meetings of this Institution some general *résumé* of the present conditions governing the designs of ships generally, and although I do not propose to go into the very large question of mercantile ship design, I venture to think that a few remarks on the present aspect of warship design may not be without interest to the members who are present, and may possibly call forth an interesting discussion from some of our continental members, who have not had very frequent opportunities of attending the meetings in London.

Now that the war has been over for three and a-half years, we can glance at the whole situation with a calmer view than could be taken of it at a date less distant from the close of hostilities, when our minds were still working at fever heat to produce continuously improved weapons, both of offence and defence.

It is hardly necessary to point out that in the years immediately preceding the war enormous developments had been made in naval architecture, in marine engineering and in gunnery, and other branches of engineering science directly bearing upon the design and production of war material; but, although this development was very evident in the years immediately preceding the war, as soon as the war started it proceeded at an incredibly increased rate, being largely helped by the fact that during the war the question of cost hardly had to be considered at all, provided that the war material could be so improved and supplied as to aid in the achievement of victory. This factor alone contributed to the extraordinary advance made in every kind of scientific weapon, to a degree which had, I think, never before been approached; for, though in earlier wars the same kind of thing no doubt took place, on all previous occasions science had not progressed to anything approaching the condition in which it was found in 1914, and therefore on no previous occasion had it been possible to make such extraordinary improvements in scientific implements of all kinds. These improvements profoundly affected the designs and characteristics of our ships. Entirely new types were developed and the old types were improved, and as the war proceeded and battles were fought, new lessons were learnt and the results were as far as possible embodied in new construction. An interesting point, I think, is that although, as I say, new types had to be developed, yet it was found that all the existing types, perhaps with certain modifications, were of great utility, whether capital ships—battleships and battle-cruisers—light cruisers, destroyers or submarines. Owing, however, to the long time which it takes to construct the heavier classes of ships, the developments made in the smaller types were more marked than in the larger, because the new material was always wanted at the earliest possible moment.

Now that the war is over and we have been able to think more calmly about the whole question of design, certain points stand out which call for more particular study and comment than was the case in pre-war days.

One of the principal points to be specially considered is the great development of under-water attack, whether by submarines, mines or torpedoes, all of which greatly added to the danger to which ships were continually exposed. Submarines became much more efficient, mines were laid in numbers over an extent never before dreamed of, and torpedoes were increased in size and efficiency, and were carried in larger numbers by all classes of ships than had ever been previously experienced. It therefore became almost a necessity to pay special attention to the under-water protection of, at any rate, all the more important classes of ships, and it may therefore now be taken, I think, as an axiom that capital ships must have a very large proportion of weight devoted to their under-water defences. In this connection, I think it should be remembered that the older classes of ships which had been designed some time before the under-water attack had become so imminent a danger, in almost all cases came off badly when struck by torpedoes or mines. This was due in part to the inferior protection given to the sides of the ships below water, and also very largely to the fact that in many cases longitudinal centre line bulkheads were fitted which prevented the ships retaining an upright position when damaged on one side; the large amount of water admitted was thus confined to the damaged side only, and in this way many of the older battleships and cruisers capsized. One of the first objects, therefore, was to improve this state of things, and none of our later ships fitted with the newer forms of under-water protection was ever lost by the action of an enemy torpedo.

The second great point of difference which has to be considered in post-war designs is the very much greater range at which actions were fought during the war than had been anticipated, and this in spite of the rather unfavourable atmospheric conditions which generally obtained in the North Sea. In future ships, therefore, the ever-increasing range of the guns themselves and of the distances at which actions are likely to be fought must be kept in view to an extent not contemplated in earlier designs. Before the war it was thought that actions would be fought at perhaps something under 10,000 yards range. Now provision has to be made for ranges fully twice as great. To the ordinary observer it might not appear that this difference would very profoundly affect the designs of our ships, but a very little consideration shows what an important matter it is. At ranges under 10,000 yards the projectiles, as a rule, when striking the object, are coming down at an angle of certainly not more than 15 deg. to the horizontal, whereas at the greater ranges the angle of descent of the projectiles may be 30 deg., or even more. At these steeper angles of descent the decks of the ships present a larger target than the sides, and with the old thicknesses which were given to protective decks in former designs, the larger shells would have no difficulty in penetrating to the vitals, so that one good shot from a big gun might enter a magazine and explode it, thus destroying the ship in a moment. It therefore becomes a paramount necessity to increase as far as possible the thickness of protective decks over the vital parts of the ship, whilst we still have to maintain the armour belt in the neighbourhood of the water line in order to preserve intact the water-plane and the stability.

A further point necessitating special attention being paid to the protection especially of decks is the new menace of attack from the air. This has added an entirely new factor to modern naval warfare, though even at the end of the war this method of attack had not really been developed nearly as highly as it is likely to be in the future.

The naval designer, therefore, at the present moment is faced with the necessity for providing against new forms of attack both above and below water, all of which demand greatly increased weight in the working out of the design. At the same time he is offered no compensating advantage, or very little, in the reduction of side armour or any other item; for as the size and weight of the guns have continually increased, so had also the demand for increased speed, and therefore the weight of propelling machinery, boilers, fuel, &c.

Some advance has no doubt been made in the improved quality of steel, but any slight saving in weight of structure which can be made by the introduction of better material is not at present enough to compensate for the increase of weight due to additional items such as wireless and control apparatus and many other additional fittings.

These considerations, therefore, taken together, have tended to produce very large and very costly capital ships, and they would no doubt have increased to an enormous extent had not some limit been put to the size of ships and guns by the Washington Conference. In view, therefore, of the general necessity all over the world for economy of financial resources, if for no other reason, the enactments of the Washington Conference should be welcomed at any rate by the taxpayer, if not by the men of the fighting forces themselves, and I may perhaps add, by the naval architects and suppliers of munitions of war.

Consideration of these points naturally leads to the questions: Are these enormous ships worth building? Can they be regarded as necessities? Can they be relied upon as the best means of defence and attack, or will they become an easy prey to some of the new methods of attack which have been enumerated?

Although the increased efficiency of attack under water, and also from the air, demands our earnest attention, nevertheless experience shows that the exaggerated claims of the enthusiasts who favour submarines on the one hand, or those who advocate aircraft on the other, should not be allowed to carry too much weight. For novel weapons it is always claimed by their advocates that at last an arm has been discovered which supersedes all others, and may, in fact, put an end to war, so irresistible is its power compared to that of all previous war material. Such claims have in the past been advanced for the rifle, the big gun, the machine-gun, the torpedo, the torpedo boat, the submarine, and many other engines of war, but every time experience shows that the potency of new inventions can be met by some antidote, which largely discounts the value of the idea, and experience compels the claimants of irresistible force to modify their earlier optimistic prophecies of the wonderful results of their discoveries.

It is hardly necessary to go into all the arguments of the necessity for having capital ships; but after weighing all the facts, it is generally admitted by competent authorities that as long as ships of any kind sail on the surface of the seas, the most powerful surface craft will always be the principal unit of any fleet.

As far as defence goes, at the moment our experiments and actual trials on the full scale show that we can make our ships reasonably secure against under-water attack from mines or torpedoes or from bombs dropped in the water alongside. Further, I consider that the decks can be so thickened as to be able to withstand modern gunfire at long range, or any bombs of weights which can at present be carried, provided always that too great demands are not made upon the naval architect to carry an abnormal weight of artillery or that the ships should at the same time be capable of very high speeds.

One thing is quite certain, viz., that with the enormous cost of capital ships, no wise man, whether he be a naval officer or statesman, would advocate the construction of the most expensive type of ship in these days of necessity for economy, unless he were convinced of the need for having them, and no experience of the war or experiments since the war show that it is possible to do away with capital ships, and to devote all the money available to the construction of cruisers, submarines, destroyers and other types. All these types are no doubt necessary adjuncts, but the most powerful capital ship it is possible to construct still remains the prime necessity of any first-class navy.

As regards other classes of vessels, the war showed the necessity, as I have said, of nearly all the classes previously developed, which was, I venture to think, in itself a testimony to the foresight and intelligence of the naval officers and naval architects of the various great navies

* Institution of Naval Architects, Paris Summer Meetings.

of the world. Demands were made in every class of ship for more speed, more armament, and more protection, so that every type tended to get larger and larger. This is seen in the continually steady increase in size of light cruisers, of destroyers, and of submarines. Perhaps the development of the latter of these classes was the most remarkable of all, and showed a greater percentage of increase of size and of speed in the same period than had been achieved in any other type of vessel. It is only a few years since the largest submarine was of a few hundred tons displacement. At the end of the war there were submarines of 3000 tons weight and having speeds up to 24 knots; and the British Navy had developed some experimental boats carrying a 12in. gun.

An entirely new type of ship, which was developed during the war, was the aircraft carrier. At first small merchant ships were taken up and adapted for this purpose, but as the necessity for carrying aeroplanes at sea became more and more insistent, larger vessels were taken up, and the special arrangements for flying on and off were developed to a very high degree. Although most of the aircraft carriers are still converted ships built originally for other purposes, the alterations are so extensive that the ships as converted practically amount in many cases to an entirely new design. These vessels, which really correspond to the large hangars on land at the back of the fighting armies, are required to keep up with our fleets and therefore to have a high speed, to have good sea-going qualities, and to be steady platforms for flying off and flying on, with all the special fittings and arrangements necessary to carry out these operations successfully; and there is very little doubt that large aircraft carriers will in the future form an integral and absolutely necessary portion of any first-class fleet; and, further, these vessels will no doubt be specially designed for the purpose and developed to even a greater extent than has hitherto been the case.

It would seem to be difficult to arrive at any finality in the design of aircraft carriers, owing to the immense progressive development of aeroplanes, especially those of the larger classes designed to carry heavy bombs and other weapons of attack. To arrange for the safe flying off, landing, and stowage of these big machines has given the naval architect new problems in ship design, which appear to call for quite as much inventive genius as any of the older problems with which naval architects have hitherto been faced.

Reviewing the whole situation generally of the tendency of warship designs as affected by the war, it appears that the naval architect has to deal with an even more complicated set of requirements which must be met in the up-to-date warship than ever was the case before; for, in spite of the fact that the war lasted over four years, no finality was reached in the development of any of the weapons of war which were in use up to the Armistice, so that, although the ship designer is aware of the many varied and difficult problems which presented themselves to him during the war, most of which he successfully overcame, he has still to consider the further problems of more or less unknown character which the enormous development of science has brought about in the ever-increasing power of weapons of offence and defence which have to be provided for in the design of warships.

AIR SERVICES IN NORTHERN AFRICA.

THE development of regular air lines in Northern Africa is engaging the active attention of the authorities, and Colonel Sacconey, Director of the Aerial Navigation Service, is at present in Algiers, discussing with the Délégations Algériennes the granting of subsidies for the establishment of a network of air lines in Algeria and Morocco, and later across the Sahara to Timbuctoo. Colonel Sacconey states that three large aerial ports are envisaged—Algiers, Casablanca and Tunis. There are to be five lesser landing places at Gabes, Constantine, Oran, Biskra and Touggourt. Four seaplane stations will be established at Tunis, Algiers, Gabes and Oran, and ten emergency landing grounds for aeroplanes and six for seaplanes will be installed.

At present, besides the regular service from Toulouse to Casablanca by way of Spain, there is a regular service between Algiers and Biskra, which in April and May carried a number of passsengers. The service is at present suspended, but when the hot weather is over it will be reopened for the tourist season. It is this line which it is proposed later to extend to Touggourt, and thence across the waste of the Sahara *viâ* the posts of Wargla, Nassi Inifel, Insala, Timmisao and Tilimssi to Timbuctoo. That this route, although perilous, is nevertheless possible, was proved when Lieut. Vuillemin, alone of the three aeroplane crews that set out, arrived at the Niger after crossing the desert. Of the other two aeroplanes, one was obliged to turn back and the third, with General de la Perrine on board, came down in the desert far from any post. Two of the occupants were discovered some time later in a state of complete exhaustion, while General de la Perrine, who had refused to take any water, leaving it all to his comrades, was dead. It will naturally not be possible to prevent the recurrence of such accidents, but the establishment of emergency landing grounds where water and petrol will be available, and also an improved line of wells, will do much to render them less probable.

On October 1st it is hoped to institute a regular air service between Oran and Casablanca, and next year two coastal lines, linking Gabes with Casablanca, will be established. The seaplane service now running between Marseilles and Corsica is to be extended next year to Sardinia and Tunis, or Sardinia and Bizerta. Finally, if the French Government decides to construct rigid airships, they will be employed to ply between Paris, Marseilles, Algiers, Oran, Casablanca and Dakar.

Despite the difficulties of establishing air lines in the hinterland, it is felt by the French that the aeroplane is the one method of communication which will effectively open up the Sahara, the ultimate conquest of which is the dream of so many Frenchmen who have passed their period of military service in Africa. It is held that, under the French *régime*, sufficient posts have now been established between Algiers and Timbuctoo to make the supremacy of man over the desert more than a possibility.

THREE-TON SUCTION GAS LORRY

JOHN I. THORNYCROFT AND CO., LIMITED, LONDON AND BASINGSTOKE, ENGINEERS

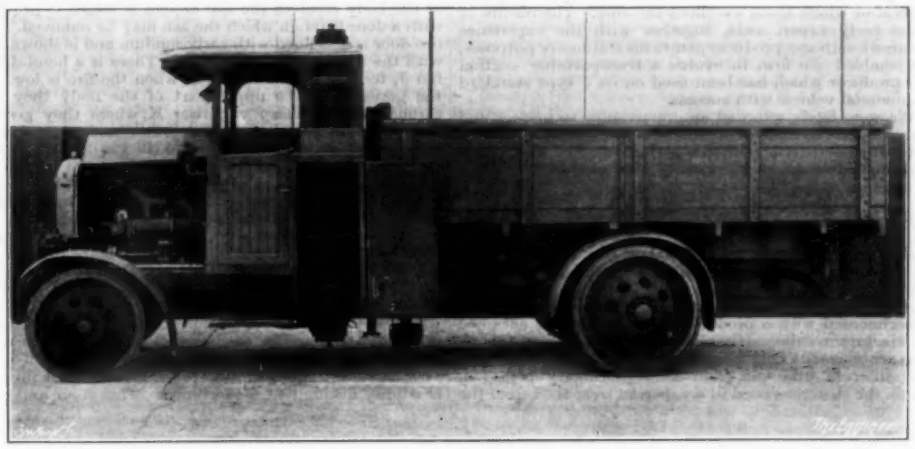


FIG. 1

FIG. 2

A Thornycroft Three-ton Suction Gas Lorry.

WITHIN recent years extensive developments have taken place in the use of the suction gas producer and the gas engine for power purposes, and to-day there are numerous successful installations which work, not only on the ordinary fuels such as anthracite and coke, but also make effective use of such fuels as charcoal, wood refuse, brown coal, peat and lignite. In view of the relatively high price of petrol, benzol, and the alcohol fuels, the attention of manufacturers has not unnaturally turned to the suction gas producer, with a view to ascertain whether with it the reduction of the cost of transport both on the road and afloat might not be effected. There are many places, both in our own Colonies and in different parts of the world, where natural solid fuels such as those previously mentioned can be obtained on the spot, and where the claims of the suction gas producer warrant careful consideration on account of the marked economy in operation which it undoubtedly shows.

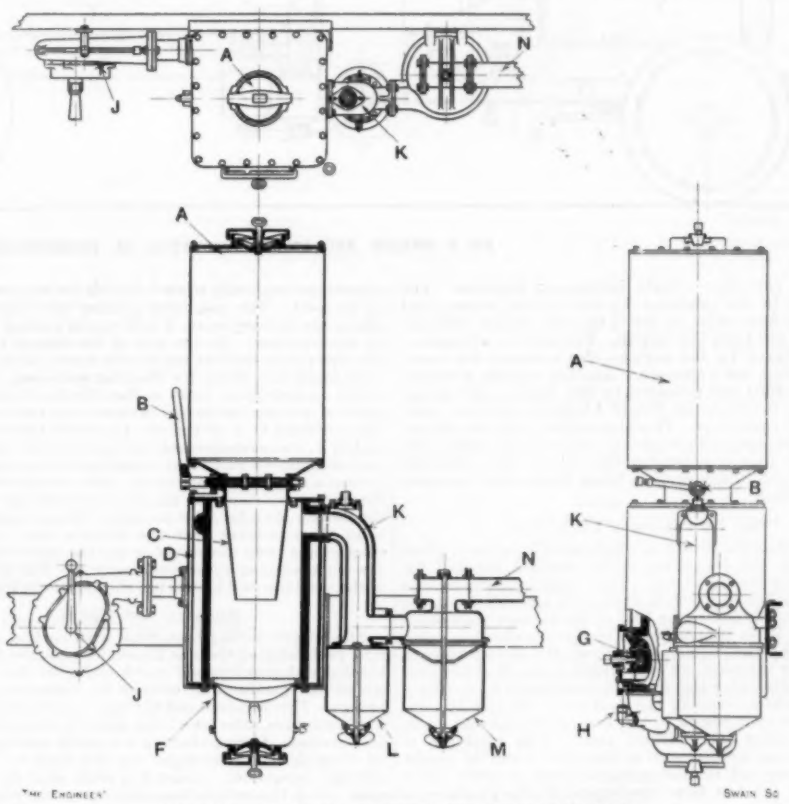


FIG. 3—SUCTION GAS PRODUCER FOR MOTOR VEHICLES

EXPERIMENTAL WORK.

The idea of applying the suction gas driven engine to the propulsion of vessels and motor launches is not new, for as long ago as 1905 John I. Thornycroft and Co., Limited, made exhaustive experiments with suction gas and fitted out quite a number of vessels with that type of plant, several of which made excellent showing. The results of these early experiments, together with the experience obtained with gas producer plants for stationary purposes, has enabled the firm to evolve a transportable suction gas producer which has been used on its J type standard commercial vehicle with success.

We were lately afforded an opportunity to inspect and test one of these vehicles at Basingstoke, and were favourably impressed with both the performance of the vehicle and the wide scope of its possible development.

THE SMITH AND PARKER PRODUCERS.

Before describing in detail the Thornycroft producer and its arrangement on the chassis, we may perhaps usefully make brief mention of two other portable type producers from which it differs in important essentials. Towards the end of the war Colonel Smith, who had previously had considerable experience with stationary gas producers, experimented with a producer on a vehicle and obtained satisfactory results. His plant is known as the Sphere. The arrangement Colonel Smith worked out, while it does not differ in principle from some stationary plants in which the steam is raised in a vaporiser over the top of the generator, embodies certain interesting features. The fuel is fed to the producer by mechanical means, and moving fire-bars assist to break up the clinker and discharge the ash from the ashpan. The same mechanism—which is driven by the engine—also actuates the water pump feeding the vaporiser. Another vehicle producer is that designed and patented by Mr. Parker, and manufactured by Producer Gas Plants, Limited, under the name of the Parker producer. This plant differs from the Sphere in that it produces the necessary steam in the ashpan by means of a ring or extension attached to the underside of the fire-bars, which projects below the level of the water in the ashpan.

THE THORNYCROFT PRODUCER.

Chief among the points in which the Thornycroft plant differs from the foregoing, is the method adopted for raising the necessary steam. The steam is produced in a separate generator which is heated by the exhaust gases from the engine, and as the heat of the exhaust gases must necessarily be in proportion to the power which is being developed by the engine at any load, the correct amount of steam for the producer is provided under all conditions. The steam generator also works in circuit with an auxiliary vaporiser which removes the heat from the gas by conduction before it passes to the dust collectors and on to the gas cooling and delivery pipe. The producer is designed as an integral part of the chassis and its weight has been reduced to the greatest extent possible. The delivery of the fuel from the hopper to the producer is effected by the action of gravity and there are no mechanical movements connected with the apparatus.

The photographs and drawings which we reproduce show the arrangement and details of the producer as fitted to the firm's standard J type chassis. Fig. 3 is a drawing showing the arrangement of the producer. The fuel is contained in a hopper A which communicates through the control valve B with the fuel cone C inside the producer. The body D is composed of a rectangular shaped casting which is lagged on the outside and is filled internally with a carborundum lining. The lower part of the body receives the ash hopper F which is provided with a door through which the ash may be removed. The fire-door is also lined with carborundum and is shown at G with the steam connection at H. There is a hand-driven fan J, for use when starting or when the fire is low. As the gases leave the upper part of the body they pass through the auxiliary vaporiser K, where they give up their heat to the surrounding water and pass through the dust collectors L and N and to the gas delivery pipe.

The arrangement of the installation on the chassis will be seen from Fig. 4. The producer itself is neatly accommodated in a light steel box at the side of the driver's cab—see Fig. 1—and is easily accessible for inspection and attention. The necessary water for steam raising is carried in a large tank P fixed to the dashboard and the water passes through a float arrangement R to the steam generator S. As already described, the steam generator is heated by the exhaust gases from the engine, and with the exception of the connection to the auxiliary vaporiser it is independent of the producer. Fig. 4 shows an enlarged sectional view of the steam generator, from which it will be seen that it is built round the engine exhaust pipe and is readily dismantled for cleaning. This is an important advantage, especially when brackish or impure water has to be used. The gas, after passing the dust collectors, enters the delivery main T and passes around the chassis to the scrubber. At the end of the wagon body, where the pipe passes beneath the chassis frame, there are elbows with inspection doors for cleaning purposes. The effect of the long delivery main is that the gas is considerably reduced in temperature by the time it reaches the scrubber. The scrubber U is of the dry type with horsehair filling, and in it, too, arrangements are provided for ready access and cleaning—a matter of considerable importance when fuels of a tarry nature are used. After leaving the scrubber the gas passes direct to the engine, where at V it enters the mixing chamber, the air supply being controlled by a hand throttle lever near the driver's seat. Additional connections from the scrubber are the waste pipe W and the engine-driven rotary exhauster X. The arrangement of the scrubber and blower are shown also in Fig. 2.

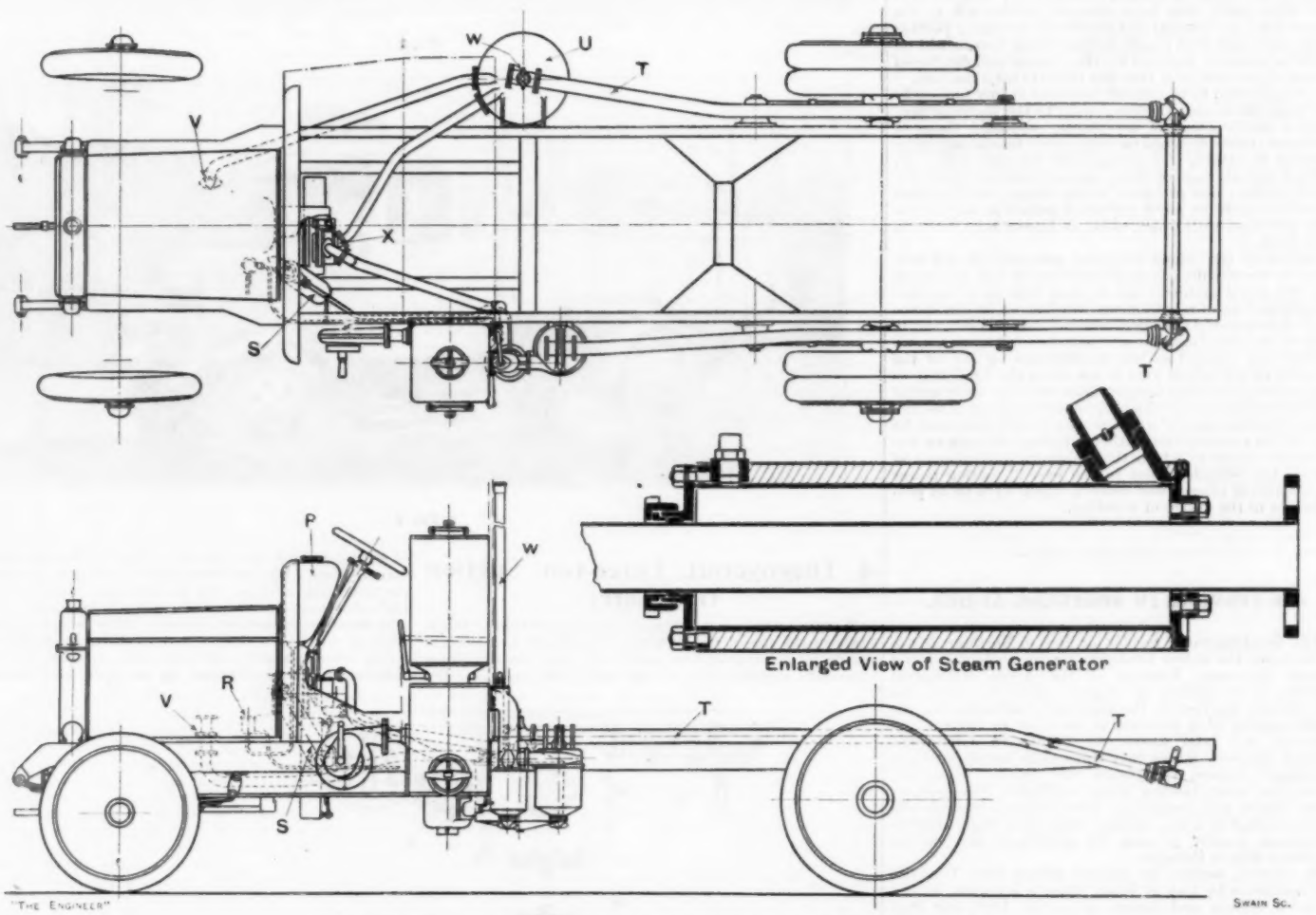


FIG. 4—CHASSIS AND STEAM GENERATOR OF THORNYCROFT SUCTION GAS LORRY

RUNNING AND TESTS.

The hopper having been filled with anthracite or other fuel, preferably of the size known as peas, the fire may be kindled with shavings and wood, and after the fire-door is closed the producer is started by operating the hand blower. This process need not take longer than from five to ten minutes, after which the engine is ready for running on the road. During starting the waste gases pass to the air through the waste pipe. On the lorry we tested the starting operation, occupied a little over five minutes, after which the vehicle was running on the road. It has been urged against the suction gas driven vehicle that it is somewhat slow on hills, but the pulling capacities of the vehicle under consideration were good and improved as the trial proceeded, while the general flexibility of the engine was all that could be desired. When coasting down hills it is usual to give excess of air so that the engine draws a very weak mixture which cannot ignite and is simply rejected to the exhaust. When the vehicle is standing the engine-driven rotary exhauster may be set in operation, by which means a sufficient supply of gas to keep the engine in motion is maintained. We understand that the special arrangements which are made to maintain and supply just the correct quantity of gas when the vehicle is standing with the engine running light, or when coasting down hill are the subjects of patents by the firm.

We append, herewith, some particulars of test results obtained when running on anthracite and also on charcoal fuel, which have been supplied to us by the makers :—

Tests of Thornycroft Gas Producer Fitted to J Type Chassis.

Date of test	6/4/22	26/4/22
Distance in miles	28	28
Time (non-stop run)	2 h. 20 m.	2 h. 5 m.
Speed, miles per hour	12.0	13.4
Fuel	Anthracite	Charcoal
Calorific value 100 per cent. dry, B.Th.U. per lb.	15,000	14,200
Calorific value as used, B.Th.U. per lb.	14,700	13,200
Moisture content as used, per cent.	1.8	7
Fuel consumed, in lb.	70.5	109.2
Fuel, in lb. per mile	2.51	3.9
B.Th.U. per mile	36,897	38,280
Gross ton miles per lb.	2.97	2.73
Weight of water used, lb.	45	35
Gross weight of vehicle	7 t. 10 c. 2 q.	7 t. 9 c. 2 q.

The results of a series of analysis of the gas from the vehicle producer which were taken during a road test, are shown below, and it will be observed that the quality of the gas varies with increasing temperatures. During these tests the amount of water used on the producer was approximately half the amount of fuel by weight.

Particulars of Gas Analysis.

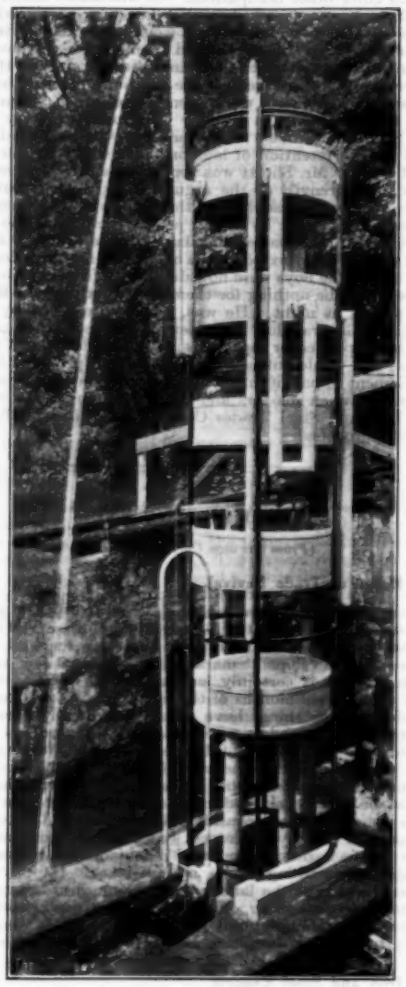
Constituent.	Percentage.	Percentage.
CO	19.5	29.5
CH_4	2.3	4.6
H_2	23.5	15.5
CO_2	4.0	1.6
O_2	3.5	0.5
N_2	47.2	48.3
	100	100
Temperature of gas, deg. Cent.	760	1150
Calorific value, B.Th.U. per cu. ft.	100	180

With regard to relative fuel costs when running a Thornycroft J type lorry on suction gas or petrol, if the price of petrol be taken at 1s. 10d. per gallon and that of anthracite peas at 63s. 11d. per ton, then the cost of suction gas works out at a little below one-third that of petrol. These figures were, we are informed, arrived at as the result of trials with actual vehicles in commercial use doing long and short daily journeys.

SURVEYOR'S CAMERA.—We are asked to state that the surveyor's camera which was exhibited at the conversazione of the Institution of Civil Engineers on the 27th ult., and was referred to in our issue of the 30th ult., may be inspected at the offices of B. J. Hall and Co., Limited, Chalfont House, Great Peter-street, Westminster, S.W. 1.

The Hydrautomat.

IN our issue of June 16th we gave a description of the hydrautomat, or apparatus for raising water without machinery, which is being exploited by the Allen Hydrostatic Pump Syndicate, of 106, Victoria-street, Westminster, S.W. 1. We have just received, and reproduce herewith, a photograph of the first apparatus of the type to be publicly demonstrated. It is that which we saw in operation at Carshalton. In the engraving the water is being discharged, and the lowest cistern, or operating chamber as it is called, is being filled with water from the



THE HYDRAUTOMAT

head race, so that water is being forced from the central closed chamber into the open cistern above it, and from the closed chamber at the top out through the delivery pipe. On the next or suction stroke, brought about by the automatic discharge of water from the operating chamber, water will be sucked from the open cistern, lowest but one in the tier, into the central closed tank, and from the open cistern immediately above the latter into the closed tank at the top. The actual difference in level between the surface of the tail race and the invert of the discharge pipe is 13ft. 6in., and as it is arranged the apparatus is lifting at the rate of 10,000 gallons per day.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Optimism Abroad.

THERE is a spirit of optimism abroad, for the trade improvement continues to develop, though slowly, it is true. The symptoms of the Birmingham iron trade are more favourable than they have been for some time past, and it is considered certain that the Staffordshire works must soon get their share of the large business gradually coming into the market. Some producers whose plants have been standing idle for a long time are canvassing the chances of a sufficient broadening of demand to justify re-starting. In one or two instances, it is stated, millowners have committed themselves to new enterprise, while in others more regular working is assured by orders which have been booked. July and August are, however, usually the quietest months of the year, consequently the date of the long-looked-for revival is being postponed until the autumn. In engineering circles, too, the tone shows improvement, and the large firms speak of a glimmer of light ahead. Mr. Edward Steer, chairman and managing director of Guest, Keen and Nettlefolds, Limited, at the annual meeting of the company in Birmingham recently, expressed the opinion that the signs of a possible revival in trade were more evident than they were twelve months ago, but, he added, "they require to be nursed and encouraged in every way." No real and lasting revival was possible while taxation, even allowing for the recent reduction in income tax, remained at its present level. Apart from its moral effect in disheartening the trader and discouraging enterprise, it prevented the growth of capital reserves which were indispensable to progressive business. The lower bank rate should go some way to stimulate business, and the reductions, although quite inadequate, which had taken place in transport charges on coal and coke and raw materials for blast-furnaces and steel works, would be of some assistance. All these were welcome signs of a change for the better, but a far more rigid economy in public expenditure was necessary in order to secure that substantial alleviation from both national and local taxation which must be obtained before a true revival in industry could be expected.

Staffordshire Pig Iron Activities.

The possibility of the production of forge and foundry pig iron being renewed in South Staffordshire seems to be drawing nearer. Undoubtedly, the chief weakness of the situation is the semi-starved condition of some of the chief iron and steel consuming industries in the district. The engineering concerns, however, are getting very short of pig iron and orders are now usually accompanied by pressure for prompt delivery. Stocks at furnaces are said to have been absorbed to a great extent, and with so few furnaces going and the autumn not far off there does not seem to be much fear of a relapse. Accordingly the tone is more confident, and there is talk of at least three Midland furnaces preparing for a restart either in August or September. These furnaces have been unemployed for fourteen months at least. A significant feature of the pig iron market is the decided firmness in values, concessions being entirely refused. This is assisted by a small increase in coke values, sellers of furnace fuel declining to accept forward business without an increase in price. More money is asked for special brands of iron, the makers of which are well sold or have their own outlets for the production. This, it is considered, is rather by way of testing the strength of the market than with any expectation that the prices quoted would lead to business. The demand is not so widely diffused as really to consolidate the position.

The Bar Iron Trade.

Reports of the Staffordshire manufactured iron trade are pitched in a more optimistic key. Nut and bolt makers are still operating more freely, and though their orders to the bar manufacturers are more numerous, they remain, generally speaking, on the small side. Some makers, however, are beginning to see further ahead, and are placing orders for material to carry them over the next few months. Belgian exporters are again fighting for a footing in the market by reducing quotations to about £8 15s. a ton delivered Darlaston, but home makers are favourably placed in the matter of deliveries. The mills are fairly well occupied, reports suggest those in Lancashire to a greater degree than in Staffordshire, and sellers show an inclination to adopt a rather firmer attitude in respect of prices. Though competition for orders is keen, prices are firmer and only in very rare cases can nut and bolt qualities now be bought under £10 and fencing iron below £10 2s. 6d. The higher grades of unmarked bars are quoted up to £11 15s. in a few cases, but this is considerably above the value which buyers put on even good merchant bars which change hands at £11, and in some cases slightly less. Marked bars remain firm at £13 10s., and inquiry has expanded, though the mills could do with more orders. Certain leading concerns have declined to enter the competition for business, regarding the prevailing cut prices as perilous to their industry. Galvanised sheets are in slightly better request, but business is slow, and it is possible to obtain concessions from the standard of £16 f.o.b. Liverpool. The demand for black sheets has improved a little, with prices a shade firmer.

Steel.

There is not much movement in steel in this district, though rather more steel work is coming into the market as the result of a slight increase of activity at the shipyards. Billets and sheet bars command about £7 10s., though business is stated to have been put through on lower terms. The competition from the Continent is not now very formidable. Foreign supplies can be offered at something less than £7 5s. probably, but the price advantage is insufficient to outweigh the disadvantages attaching to the export trade in a sluggish and unstable market. These alternative sources do act as a counterpoise to home values, however. The local steel makers will benefit to some extent from the withdrawal of competition with northern districts, as the result of the recent agreement to restore the territorial selling arrangements. The new arrangement under which a reduction from the home price is conceded where the material is used on export constructional work is being shared by local steel works. The concession does not exceed 5s. per ton, however, a smaller concession than is made elsewhere, makers generally being dissatisfied with prices and indisposed to increase their losses. Competition has become keener with the steel rolling works, some of which continue to accept orders at lower prices than the big steel works are prepared to entertain.

Fewer Unemployed in West Midlands.

It is regarded as most satisfactory that the number of unemployed in the West Midland area continues to grow less. The latest returns show a decline in the total number of unemployed of 4149 on the previous week for this area. This fall takes the total down to 184,232, against 188,381 recorded a week earlier. To this number, Birmingham is contributing 64,923, which is 276 less than the previous week's figure of 65,199. West Bromwich is contributing 4713, which represents a fall of 296 on the week. Wolverhampton's portion is 9546, which is a slight increase on 9529 recorded the previous week. Smethwick's total is 8908, which is 600 less than the week before; while Coventry's total of 7719 represents a drop of 874.

Submerged Coal in the Black Country.

Owners and lessees of coal mines in the Old Hill district have just put into execution a scheme for relieving the flooding of the mines in that part of the Black Country. They have voted themselves out of the Staffordshire Mines Drainage Scheme, except so far as it deals with surface water, and will now defend their own properties independently. They have acquired a pumping engine, which was formerly in use at Deepfields, and with this and other resources they hope to arrest the mischief. The endorsement of the scheme by the Secretary for Mines means that all the mineowners drawing coal in the area will be subject to a compulsory levy to defray the expense of pumping. It must be realised that the scheme cannot be regarded as more than an emergency measure. It will not insure South Staffordshire against the danger of loosing a large part of its coal resources on which the industrial well-being of the district depends. It is considered, however, that the engineering problems involved could be overcome if all the interests concerned were disposed to co-operate.

Midland Miners' Wages.

The ascertainment of miners' wages for the Cannock Chase, Derbyshire and Warwickshire areas for the month of July, announced this week, show that the minimum wage for stallmen is reduced from 10s. 9d. to 10s. 1d. per day, the reduction amounting to 10.65 per cent. on the wages basis. This decrease follows upon the reduction of 1s. 1d. per day which took place in June.

Obituary.

I regret to have to record the passing of another well-known figure in Midland engineering circles, Mr. Frederick Howard Cartland, who was formerly a director of James Cartland and Son, Limited, engineers, of Constitution-hill, Birmingham. Until recently, he lived at Solihull, but died in Devon, where he had since gone to reside, as the result of a seizure.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER, Thursday.

General Outlook.

IT cannot be denied now that the iron and metal markets are returning to their old state of dullness which was supposed to be caused by the stoppage in the engineering industry. People are beginning to realise that there are other and deeper-lying causes for depression, and as the stoppage is out of the way these causes are asserting themselves. The poverty of the world is one of them, and the high cost of construction of all kinds is allied to it. It is not now because material is impracticably dear that industry is checked; for although there is room for reductions yet in a good many of the current prices for iron, steel and metals, they are all moderate in comparison with prices two years ago. The comparatively high cost of living is at the bottom of many of the high costs of construction, and, of course, one means the practical cost of living and not the theoretical figures with which officials mock us from month to month.

Metals.

The position in the copper market has not undergone much change since we last wrote. The American market is quiet, and it is still feared that the rate of production of new copper is excessive. The actual prices, however, in America are rather better than they were a week ago, although this is counteracted here by a rise in the exchange. The general opinion amongst merchants here seems to be that there is no immediate prospect of a rise in copper prices, and, of course, the demand in the Manchester district is poor, and this may perhaps have an effect on the minds of local merchants and encourage a pessimistic attitude. Activity in the engineering trade here is mainly confined to the textile machinery branch of the industry, and there is no very great scope for the consumption of copper in this branch. Hence Manchester opinion as to the prospects of the copper market may perhaps be unreliable, at any rate to a certain extent. It is noticeable that the market for old metals of all kinds remains very weak, and that the prices at which they are bought and sold are still a long way below their intrinsic value. This is a feature which always means a poor market for the new metals, for when there is any good demand consumers are more ready to consider offers of scrap. Dealers here are still offering only £38 to £40 per ton for gun-metal scrap, and about £28 for yellow brass. They were giving rather higher prices for clean copper scrap up to a few days ago, but they seem to have been reducing these prices lately. Tin has been a quiet market, without much change, but there seems to be a growing suspicion that there is something going on behind the scenes which is not altogether clear. It will be remembered that the Federated Malay States gave a kind of promise that they would not realise their reserve stocks of tin at the present comparatively low prices, and the impression has been created that these stocks were to be held back until the market rose to £200 or thereabouts; but recently tin shipments from the East have been heavy, and it is difficult to account for them by tin production. Another point is that more tin is coming in than can be sold to consumers, and yet the market is held up. There is talk of the manipulation of a powerful syndicate, but in any case confidence in the market here is somewhat shaken.

Lead and Spelter.

The market for lead has again become very firm, especially for prompt delivery, and the difference between prompt and forward has again increased to 25s. per ton. The feeling here is that the metal is dangerously high. Spelter has been rather a better market of late and the price has improved by about 10s. per ton, but the consumption of the metal seems still to be small.

Pig Iron.

The position of the pig iron market in Manchester changes very slowly, if it can be said to change at all. There seems to be rather less demand this week for foundry iron here than was the case last week, and so far as one can gather the orders given out are for small quantities. One does not know whether the consumers are expecting to buy foundry iron on better terms, but the makers of Derbyshire iron—which is the only kind which matters much at present—contend that they are close up against the cost of production and cannot make any further concessions. Reports that the Cleveland export demand is slackening suggest that possibly Cleveland No. 3 will be reduced, but in any case that would scarcely affect Manchester even if Cleveland prices approximated to the Midland prices. What might bring down iron prices here would be the re-starting of the idle furnaces, particularly those in North Lincolnshire; but there is no indication at present that this step is likely to be taken. Forge iron is unchanged and much neglected. Hematite iron is easy, and the price for East Coast brands is only 3s. per ton above that for common iron.

Finished Material.

The market here is very dull for finished iron and steel, and the orders coming in are described as for trifling quantities and for immediate delivery. One does not see how the manufactured steel prices can be reduced, but there seems to be room for some reduction in the Lancashire iron prices. Trade, of course, wants cheaper steel, but to get it one needs a supply of much cheaper semi-steel.

Scrap.

In the scrap market one finds very little business being done. Dealers are still dissatisfied with the price at which they can sell heavy wrought scrap, although this has been raised from 65s. to 70s. delivered. The foundries are not now buying cast scrap very freely, and apparently about 80s. per ton is the best that can be obtained for good ordinary machinery metal. In steel scrap there is no change here, and the prices to be obtained for it do not pay the costs of collection.

BARROW-IN-FURNESS, Thursday.

Hematites.

There is a better feeling in the hematite iron trade, and there is every reason to anticipate a slow but sure improvement. There are more buyers and more inquiries, but the tonnage is still limited, and it is reported that there are some prospective buyers who are arguing for a reduction. From a maker's point of view this is not likely, in view of the narrow margin of profit. Any relief will have to be the outcome of reduced railway rates. The continental trade still continues, and there is an improvement with the trade with the Midlands. The fact that shipbuilders and shipbuilding engineers are in such a quiet state naturally affects the market and restricts the orders. At present the output exceeds the demand, but it is expected that soon matters will balance themselves and that the present stocks of about 50,000 tons will be cleared. Trade in ingot moulds continues with South Wales (Llanelly).

Iron Ore.

The iron ore trade is not brisk, and will not be until there are more furnaces in blast. The consumption of native ore is confined to the district practically. Spanish ores are arriving, but not frequently.

Steel.

The steel trade is slightly better, but there is no great promise in the market yet. There is work for some weeks on orders held, but not to a very great extent. The rail and merchant mills are engaged and the hoop mills continue brisk. Adjoining the hoop mills is a new department nearing completion which will manufacture sections, mostly for the Sheffield market. Foundries are moderately employed.

Shipbuilding and Engineering.

Both trades are very dull and no new orders are reported. Vickers are completing the Commonwealth liner Jervis Bay and an internal combustion engined tanker of 10,000 tons. Work has not yet been resumed on the Cunarder Servia as yet. In one of Vickers' engineering departments work is going on in mining machinery which will take a month or two to complete yet.

SHEFFIELD.

(From our own Correspondent.)

Encouraging Signs.

ALTHOUGH the return to anything like normal conditions is a disappointingly slow process, signs are not wanting that there is a movement in that direction, even in Sheffield, which seems to have lagged behind when many other industrial centres have made good headway. There are still over 40,000 unemployed in this district, but each week sees an additional number of furnaces, forges and steel rolling mills at work; while orders are said to be increasing in number, though still individually of comparatively small dimensions. Some of those best able to estimate the trend of business say that there will be nothing like a general resumption till the New Year. In the meantime, however, many firms are feeling the pinch in a financial sense very keenly, and the bankruptcy returns are revealing the seriousness of the position. Other firms which are better able to stand the strain are having to pass the dividends customarily paid at the half-year or to reduce them. Vickers' directors, it is true, have just announced a prospective distribution of 5 per cent., less tax, but it is generally believed that the move has been made possible in consequence of the long-deferred settlement with the Government, rather than on last year's operations at the Sheffield works. On the other hand, one of the most significant evidences of revived confidence on the part of local steel manufacturers is the substantial sale of billets to the rolling mills during the last week or two. It is now generally recognised that prices have reached their lowest limit. Locally, soft basic billets are being sold at £7 10s. to £7 15s., but Lincolnshire makers are accepting £7 5s., delivered in Sheffield. Continental prices are no longer competitive at these figures. More blast-furnaces and steel furnaces are now at work in Lincolnshire, and, as intimated in these notes last week, the United Steel Company has started half a dozen of its big furnaces at Templeborough, while the Park Gate Steel works are also active. Sheffield has recently been sending increased shipments of best quality crucible steels to America, but generally speaking the revival has not yet spread to this branch, which cannot hope to get really busy until more engineering tools are required, and the still considerable surplus of tool steel remaining from the war stock is exhausted. The ferro-alloy market is also very quiet, though some fairly big orders for ferro-manganese have been received from America during the last week. The small tool trade is distinctly busier; the hand saw trade is quite brisk and the improvement extends to mining and quarry tools, files, saws and twist drills.

The Fuel Position.

Conditions in the coal trade do not give much ground for optimism. In South Yorkshire and the North Derbyshire and Notts. area quite a number of the smaller pits have been stopped, either permanently or temporarily, till prices improve or costs lower. There is, however, little prospect of either of these factors changing. Iron and steel makers say they cannot carry on their works profitably until fuel costs come down, while, on the other hand, the miners are getting more and more restive, and they are not likely to be pacified as a result of the percentage addition ascertainment which has just been arrived at in the eastern area—which comprises Yorkshire, Notts. and Derbyshire—by which wages this month will be further reduced 10.65 per cent., a maximum of 8d. per shift. Already at the Hatfield Main Colliery, in the Doncaster area, the colliers have "downed tools" as a protest against the reduction in the price list which has been suggested there. Mr. Charles Markham, who is largely interested in the South Yorkshire as well as the Derbyshire collieries, and is chairman of the Park Gate Iron and Steel Company—the operations of which resulted last year in a loss of about £200,000—has been so much disappointed at the failure to earn any return for the workmen shareholders in this concern that he has paid out of his own pocket a dividend of 5 per cent. to all of this class of shareholder in the company. It will be remembered that Mr. Markham recently closed one of his pits because it was not remunerative, but at the urgent representations of the miners concerned, he reopened it when the men agreed to accept a reduction in wages. There has within the last week or so been a slightly better demand for industrial fuel locally in view of the improving prospects of the steel trades, but best South Yorkshire hards move only moderately in the neighbourhood of 20s., with secondary qualities 19s. at the pit, these prices being 3s. or 4s. below the official quotation on the Sheffield Exchange, which prices, it may be said, are rarely realised in actual contracts. Locomotive fuel contracts have just been arranged on this basis, a reduction of 1s. per ton, as compared with the previous contract. Slacks, owing to lessened output, have been somewhat on the short side, and prices have hardened.

Communications.

The problem of communications and transport in the South Yorkshire coalfield area, where the burdens on the roads are becoming extremely heavy, is causing the authorities a good deal of anxiety. The repair of bridges over the canal which connects Sheffield with the Humber has been the subject of a conference, at which it was said there are about a hundred bridges, and the cost of the repairs would be £10,000, and the canal company has no money. A divisional road engineer, representing the Ministry of Transport, estimated that it would cost £30,000 to reconstruct two of the principal bridges. The conference was adjourned to await an offer from the canal company, in view of the future maintenance of the bridges being taken out of its hands. The problem of passenger transport between the new colliery villages springing up all round the district has also been considered by the Doncaster Corporation, which proposes to spend £20,000 on motor omnibus services, it being found that the present cost of constructing tramways would be prohibitive. Another neighbouring authority, Rotherham Corporation, is spending £50,000 on the construction of a new service reservoir.

Eminent Engineer Honoured.

Sheffield University conferred upon Sir Charles Parsons, the inventor of the turbine engine, the degree of Doctor of Engineering at last week's Degree Congregation. Mr. Douglas Vickers was to have been similarly honoured, but was unable to attend. Professor Leahy, as Public Orator, in introducing Sir Charles Parsons, said that he exemplified the importance to the practical designer of the highest possible scientific development. He turned to practical account the mathematical knowledge acquired at Cambridge by his invention of the turbine, thereby making the greatest discovery in steam power since the days of James Watt.

Sheffield Lads and Night Work.

A very influential and representative deputation attended at the House of Commons to put before Sheffield Members of Parliament the serious consequences to iron and steel industries if lads are prevented from doing night work, as is proposed by the Women, Young Persons and Children Employment Act of 1920. The deputation was introduced by Sir Charles Ellis (John Brown and Co.), and other organisations and firms represented were the Sheffield Engineering Employers' Federation, Hadfields, Brightside Engineering Company, Tinsley Rolling Mills, Vickers, George Clark and Co., Cammell Laird and Co., John Willey and Sons, Sheffield Forge, and the Rolling Mill Proprietors' Association. Sir Allan Smith, chairman of the Engineering Employers' Federation, accompanied the deputation, and, together with Mr. J. E. Baker, chairman of the Sheffield Employers' Federation, showed that Sheffield would be more seriously affected by the Act than any other town, as its rolling mills, forges and steel manipulating plants were peculiarly adapted for boy labour—probably one-third of the workers in these industries being under eighteen. It would be impossible to employ the boys by day only, as all labour in the works was on a three-shift rotation. Boys followed their fathers into the mills, and if they were not permitted to do so till sixteen, the existing shortage of labour in the iron and steel industries would be intensified, as in the meantime the boys would enter other occupations. It was stated that in the Sheffield Forge alone, where 250 boys are employed, to replace them by adult labour would cost an additional £12,000 a year. The Sheffield Members of Parliament promised to represent to the Prime Minister and the Home Secretary the seriousness of the position, and it is hoped an appointment with those members of the Government will be arranged. On Monday the Home Secretary met the Sheffield Members of Parliament, who explained the case for the retention of lads on night shifts at iron and steel works. Mr. Shortt was very sympathetic and recognised the strength of the arguments advanced that no other country had carried out the Washington Convention against night work by young people, that since the Act of 1920 had been passed, Parliament's plan for continuation schools up to sixteen years of age had been suspended, and that if the boys were now discharged from steel works there would be nothing for them to do but to run wild in the streets at night. He was, however, advised by the Attorney-General that the order having been made could not be suspended or repealed save by legislation. A one-clause Bill would suffice, but he could not promise to get Parliament to pass it unless it were presented as a measure agreed between masters and men. Mr. John Hodge, of the Iron and Steel Trades Confederation, is accordingly to be approached.

NORTH OF ENGLAND.

(From our own Correspondent.)

Hopes of Trade Revival.

WITH the advent of the second half of the year, and with conditions in the Labour world more settled than for some considerable time past, hopes are renewed that there will develop a marked improvement in trade generally. It is certainly long overdue. Looking back over the first six months of the year, one is forced to the conclusion that things have fallen considerably short of even the most modest anticipations entertained at the beginning. When the year dawned, world conditions were still too unsettled to permit of anything approaching the normal run of trade, but few anticipated that industry would be further clogged by industrial disputes, which have not only caused considerable suffering to thousands of men not directly concerned, but also inflicted a severe blow at the earnest attempt of manufacturers to restore things to something like a normal state. Happily the outlook so far as the labour world is concerned, appears to be more reassuring, and as economic conditions are gradually becoming stabilised, the position as a whole is likely to take on a brighter and more confident aspect.

Iron and Steel Exports.

Striking features of the export trade from Cleveland during the past month have been the heavy purchases of pig iron by German and American buyers. But for this demand local makers would have been in a sorry plight, as home business has been on a very restricted scale. The shipments from the Cleveland district during June to the United States alone reached 16,025 tons, a figure which exceeded the entire year's shipments to that country for any period since 1916. Helped by this figure, the June pig iron exports are the heaviest recorded this year. Belgium took 6054 tons, Germany 3410 tons, France 1750 tons, and Finland 1230 tons. The aggregate pig iron exports totalled 44,802 tons, of which 32,740 tons went to foreign ports, as compared with a total of 41,005 tons for May. On the other hand, there was a decline in the manufactured iron and steel exports, which amounted to 27,167 tons, or about 1100 tons less than the May total, and less than half the March exports. The decline was entirely due to a drop in the shipments to India and Ceylon, the May and June figures being 21,604 tons and 7280 tons respectively. While exports to other destinations have been small, trading relations have at least continued with many countries far and near, and this encourages the hope that when the purchasing power of these lands increases, North of England district will enjoy a fair share of the trade.

Imports Falling Off.

Statistics presented at a meeting of the Tees Conservancy Commission on Monday showed a falling off in the imports during June, the total of bars, billets, slabs, blooms, &c., being 5572 tons, as compared with 7824 tons in May. Pig iron imported totalled 1733 tons, as compared with 659 tons, and plates, bars, rails, joists, angles, &c., 1071 tons, as against 289 tons in May. For the eight months ending June 30th last, pig iron imported into the Tees from Holland, Belgium, France, Norway, Sweden, and Germany and coastwise amounted to 32,552 tons, as compared with 17,240 tons for the same period a year ago and 218 tons for the corresponding pre-war period of 1913–14. The imports of sheets, bars, billets, blooms and slabs from the countries named for the past eight months reached 41,218 tons, and plates, rails, joists, angles, &c., 4229 tons, as against 17,201 tons and 16,641 tons respectively for the same period a year ago.

Cleveland Iron Trade.

The position in the Cleveland iron trade shows little or no improvement on the week. The home demand

continues on a very restricted scale, and only the foreign demand deters ironmasters from blowing out a few furnaces. Now that the Scottish holidays have commenced, a further contraction in the demand is expected. Fortunately, Germany, Belgium and the United States are still buying, and some further good shipments are being made to these countries. Prices are firmly maintained, No. 1 and siliceous iron being 95s., No. 3 G.M.B. 90s., No. 4 foundry 87s. 6d., No. 4 forge 85s., and mottled and white 80s.

Hematite Pig Iron.

There is a fairly active demand for East Coast hematite pig iron. Germany is taking some good supplies, and South Wales buyers have been attracted by the cheaper prices. Some makers decline to sell below 94s., but the general market quotation for mixed numbers is 93s., at which figure sales have been made, while No. 1 is at a premium of 1s. per ton.

Iron-making Materials.

Business in foreign ore has almost ceased, consumers being content to take deliveries under current contracts, which amply cover their needs. Thus the offer of best Rubio ore as low as 26s. per ton c.i.f. fails to attract buyers. The coke market is firmer. There have been heavy export sales, and makers of good Durham furnace coke refuse to take less than 27s. per ton delivered at the works.

Manufactured Iron and Steel.

In the manufactured iron and steel trade there is just a little more foreign inquiry for railway material, and manufacturers are making drastic cuts to get orders. They have, however, only met with a limited amount of success. The mills are somewhat better employed just now, but the total tonnage of the orders booked is not large, and not a single works is doing more than carry on from hand to mouth. Home prices are unchanged.

The Coal Trade.

There is a decidedly improved tone in most departments of the Northern coal trade, which seems to promise a better prospect for the immediate future than was anticipated a while ago. The export section of the trade seems to be giving signs of expansion, and, in addition to the public contracts for abroad now under consideration, there seems to be a large inquiry from merchants abroad for private trading. It is reported that several large general inquiries are circulating for Sweden, amounting in all to approximately 100,000 tons of various classes of Durham and Northumberland coals, and also that German buyers are also coming into the market, but whether actual business is eventually booked or not there is no doubt that these inquiries are serving to strengthen the undertone. The Northumberland steam coal section, which has been the only really steady feature for some time past, has appreciably stiffened, and almost all makes are inclined to rise, especially so in the case of smalls. The Durham market is not much altered, but the collieries are working better and the situation is regarded as more hopeful. Best qualities of gas coals are fairly steady and at the full quotations, while for bunkers and all the different brands of coking there is a better demand and an improving outlook. The coke market is generally a shade easier for foundry and furnace coke. Gas coke is in quieter demand, and recent prices may be slightly discounted.

SCOTLAND.

(From our own Correspondent.)

Brighter Outlook.

THOUGH industrial conditions are not likely to improve before the holidays are here, the outlook for the autumn months is more hopeful. In certain industries an optimistic feeling prevails. It is thought that the worst is now over, and the improvement, long overdue, about to set in. Already an opening out in export business is apparent, while home consumers, here and there, show more inclination to anticipate requirements. Cheaper prices for some commodities seem imminent, and that will undoubtedly be a great stimulant to the main industries. The opinion has been expressed that the shipbuilding industry will, ere long, be much more active, and if this is borne out, the effect on the steel and iron trades will be most beneficial. There is ample room for improvement in all trades, and never were producers more anxious to do everything possible to promote business.

Shipbuilding.

Though the tonnage launched during the month of June averages well compared with the preceding months of this year, the figures are still considerably below the returns for the same period in preceding years. Throughout last month there were launched sixteen vessels of 34,906 tons, compared with sixteen vessels of 40,371 tons in June, 1921. For the six months to date the returns indicate sixty-two vessels of 167,493 tons, compared with 118 of 235,800 tons in the same period in 1921. Of the vessels launched during June, the following were outstanding:—Tjibesar, geared turbine, 11,000 tons, built for Dutch owners; the Flandria, geared turbine, 10,000 tons, for the Royal Holland Lloyd, Amsterdam; the Chuky, oil tanker, 7337 tons, for the Chile Steamship Company, New York; and the Cedarpark, oil tanker, 5000 tons, for Messrs. J. and G. Denholm, Greenock. It is said that builders are in receipt of numerous inquiries, and that if labour conditions allow, these will become certain contracts. No fresh orders of any consequence are reported so far.

Pig Iron.

Conditions in the Scotch pig iron trade are a shade brighter. There are now sixteen furnaces in blast, fifteen of which are producing foundry qualities. Home consumers show a little more activity, while the export turnover is fairly good. The demand for hematite is rather disappointing, but foundry qualities are receiving fair inquiries. At the weekly meeting of the Glasgow pig iron ring, Scotch No. 3 G.M.B. was quoted 99s. f.a.s. Glasgow; No. 3 G.M.B. Cleveland at 90s. f.o.b. Middlesbrough; and mixed numbers East Coast hematite at 95s. f.o.b. Middlesbrough. No transactions were recorded.

Steel and Iron.

The turnover in the steel trade during the past week was again of small dimensions. Plates and sectional material are very slow to move, and if the talked-of improvement in the shipbuilding trade materialises, much satisfaction will be felt in both the steel and iron trades. Black and galvanised sheets have done a little more in the export departments, but the home market is very dull. Consumers, however, are now doing more forward booking. Bar iron makers are a trifle busier on export account, but local orders are not likely to expand until prices are easier. Engineers are a little better off now, but there is ample room for expansion. The demand for scrap material has eased off meantime. A few good sales were reported, and there seems little prospect of prices dropping at present.

Coal.

The general situation in the Scotch coal trade is unchanged. In practically all branches the turnover is very restricted, and there is little prospect of improvement at present. Industrial and household consumers buy very sparingly, and are yet able to secure easy terms for the small quantities wanted. The firmness of washed nuts still provides the feature of the market. Good shipments are going from the Lothians and Fifeshire, and at most of the ports steamers have to await loading turn. Washed nuts are becoming scarcer, owing to the poor demand for round coal, and transactions are now more difficult. Aggregate shipments for the week amounted to 279,845 tons, against 278,002 tons in the preceding week and 314,017 tons in the same week in 1913.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Outlook.

THE position in the foreign coal export trade is unhappily a very unfortunate one, and gives the appearance of gradually getting worse. The situation is less favourable than it was a week ago, and prices have further drooped, while the demand is still very slow with no apparent sign of improving for some time. The Norwegian State Railways, which were recently in the market for about 15,000 tons of best Admiralty double-screened large coals for shipment over the current quarter, have bought about 12,500 tons of North Country coals, and so far have not taken any coals from this district, although they may take a small cargo from South Wales later on. It was never expected, however, that much, if any, of their requirements would come here, owing to the difference in the prices prevailing. At the moment there is no inquiry for any material amount of coal on the market, and collieries are losing a considerable amount of time. The outlook from the labour point of view is also not hopeful, as the threat of a stoppage of work throughout the coalfield is still held out. The Executive Council of the South Wales Miners' Federation has confirmed the action of its officials in postponing the tendering of the notices from July 10th to the 17th inst. by reason of the fact that the annual conference of the Miners' Federation of Great Britain will be held in the last week prior to the expiration of the notices, and it was considered advisable that at such a critical moment all the leaders should be in the district so as to deal with the situation before the expiring of the notices. One of the men's leaders has already stated that the strike of the miners on the non-unionist question is not likely to materialise, but the explanation given of this is that before the expiration of the notices the non-unionist question would have been satisfactorily dealt with, and not that there is any intention to refrain from acting upon the notices if the non-unionist question is still acute. The damage likely to accrue to business through the threat of a strike being held over the trade is very considerable, and the miners will be the first to complain when the collieries lose more time than they are doing already. The President of the South Wales Miners' Federation has not inspired confidence by a sort of manifesto which he has issued, and which contains advice and threats. He argues that with the aid of the men's organisation, which is theirs for the asking, the coalowners can check the present cut-throat competition which is destroying the income of the Welsh coal trade. He contends that the coal produced must be disposed of only at such terms as will enable the miners and their families to live a decent existence. The coal trade commercially must be organised so that wages sufficient to maintain a civilised standard of existence shall be the first charge on the industry, and he states that the organised coalowners and the organised miners have it in their power to solve the problems involved; but he overlooks entirely the prime factor of the demand and the voice which the consumer has in the question of determining prices. A list of the grievances respecting the non-employment of certain workmen after the stoppage of last year, the attempt to reduce certain rates in excess of the national agreement, and other matters which the men complain of, have been submitted to the coalowners' representatives on the Joint Standing Disputes Committee, with the request that a small joint committee should be appointed to consider the whole of the cases with a view to arriving at a settlement, and the owners' side have undertaken to consider this and give their reply later.

Railway and Dock Charges.

Towards the end of last week a deputation, representing the General Committee of Traders of this district, had an interview with the general manager of the Great Western Railway Company relative to their claim for further reductions in railway rates and dock charges, and replying to the case put forward, Mr. Felix Pole intimated his desire to help South Wales traders as far as possible, and promised to give his reply in the course of about a fortnight. The Traders' Committee submitted that the following concessions should be made forthwith:—(1) The percentage increase on railway rates should be reduced from 75 per cent. to 50 per cent. (2) The flat rate should be totally abolished. (3) Shipping charges should be reduced to 5d. per ton. (4) Non-statutory charges to be not more than 50 per cent. above pre-war. Any charges not in operation pre-war to be withdrawn. (5) The tonnage rates to 50 per cent. over those in operation in 1913 in lieu of 100 per cent. (6) The wharfage rate of 4½d. per ton to be reduced to 3d. per ton, and Swansea to be on the same basis as other Bristol Channel ports by the abolition of the dock rate. (7) The tonnage rate of 10d. per net register ton now levied on vessels calling for bunkers only to be reduced to 6d. per ton. It was further pointed out that one of the most pernicious charges in this district is that relating to vessels subjected to double dock dues. Although the dock companies may consider that such a charge was justified when the docks were under separate ownership, the traders are now unanimously of opinion that in view of the amalgamation of all the docks no such charge can be justified.

Miners' Wage Rate.

The certificate of the joint accountants for the month of May shows that the percentage on the 1915 standard rates which the industry can afford to pay for the current month is 23.23 per cent. This percentage is, however, less than the minimum laid down in the national agreement, and the minimum of 28 per cent. will therefore be payable from the 1st inst. In order to pay this minimum, the owners have to sacrifice a sum of about £26,000 of their standard profits. The total sum surrendered by the owners since November last is £1,651,000, without taking into account the indirect loss of the owners' share of the surplus profits which would have accrued if the industry had been on a paying basis. The month of May gave the best results since November last, but even with the slight improvement in prices and increases in exports the volume in that month being the highest for some years past, there has not been sufficient money in the industry to pay the minimum percentage and give the owners their 17 per cent. standard profits to which they are entitled under the terms of the national agreement.

Docks Control.

The amalgamation of the control of the South Wales docks under the Great Western Railway Company has resulted in two innovations which took effect at the beginning of this week. The first of them is the opening in Cardiff of a central stemming and inquiry office for the purpose of affording greater facilities to the traders for inquiries, orders, and information generally respecting business at the Newport, Penarth, Barry, and Port Talbot docks; and the second is that reorganisation of the traffic arrangements at the Cardiff docks were brought into operation, which, it is hoped, will result in greater efficiency and increased shipments.

Current Business.

Operations on the steam coal market have been on a very modest scale during the past week. The chartering of tonnage, which is a reliable index of the state of trade, has also been on a restricted scale. The stoppage of collieries because of the lack of empty wagons have been frequent. Reduction in the price of coals has not brought along any more inquiry, and in many instances coalowners are setting their faces against any further concessions, and prefer to suspend working their pits. Best Admiralty large are not worth more than 25s., and second qualities are quoted at 24s. 6d., which is also the figure for best Monmouthshire Black Veins. Small coals are fairly steady because of the restricted working of large coals. Coke is firmer at 36s. to 37s. 6d., and patent fuel is being quoted at 24s. to 27s. Anthracite coals are not quite so firm, except for cobbles, which are very scarce; but otherwise the demand does not seem to be so pressing

Miners' Grievances.

The owners' representatives on the Joint Standing Disputes Committee of the South Wales Coal Board have agreed to the appointment of a Committee to consider the complaints of the miners respecting alleged victimisation, &c. The owners have also agreed that a special meeting of the Conciliation Board should be held on Monday next to consider the non-unionist question.

Swansea Metal Exchange.

The tin-plate market is firmer, and makers are showing a disposition to hold for higher prices. The improvement is due largely to the pooling arrangement which came into operation this week. Makers are fairly well off for orders so far as the mills that are working are concerned.

ENGINEERING TRAINING.—For a number of years the training of pupils and apprentices has received the serious consideration of John I. Thornycroft and Co., Limited, and the firm has in operation a system which it is believed has eliminated most of the difficulties heretofore encountered in the education of students for both the mechanical and administrative sides of an engineering works. Under this system the theoretical and practical trainings run concurrently during the working day, thereby giving the student the benefit of access to the wide and varied experience of the works staff, and also enabling him to understand the "reason why" of his work in the shops and obviating the necessity for evening study. Another important item in the system is that the students are graded according to ability in small classes, thereby ensuring individual attention and an even rate of progress. The efficiency of the scheme is testified to by the following gratifying results at the recent examination of the Institution of Mechanical Engineers, at which the undermentioned eleven pupils and apprentices passed the graduateship stage:—J. A. G. Bowen, J. R. Cleave, B. M. Grace-White, W. H. Julian, R. V. Knowles, B. C. Oldham, J. R. Pearson, A. E. Read, A. J. Romer, J. F. Rose, G. M. B. Small; and R. W. Long passed the associateship membership examination of the same Institution.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	25/-
(1) Spanish	25/-
(1) N. African	25/-
N.E. COAST—	
Native	—
Foreign (c.i.f.)	26/-

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	5 8 9	—
No. 1 Foundry	5 0 0	—
No. 3 Foundry	4 15 0	—
N.E. COAST—		
Hematite Mixed Nos.	4 14 0	4 14 0
No. 1	4 15 0	4 15 0
Cleveland—		
No. 1	4 15 0	4 15 0
Silicious Iron	4 15 0	4 15 0
No. 3 G.M.B.	4 10 0	4 10 0
No. 4 Foundry	4 7 6	4 7 6
No. 4 Forge	4 5 0	4 5 0
Mottled	4 0 0	4 0 0
White	4 0 0	4 0 0
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	13 0 0	—
Part Mine Forge	*None offering.*	
North Staffs. No. 3 F'dry	4 5 0 to 4 10 0	
(3) Northampton—		
Foundry Nos. 2 and 1	*Nominal.*	
,, No. 3	4 0 0	—
,, Forge	3 10 0 to 3 12 6	
(3) Derbyshire—		
No. 3 Foundry	4 0 0 to 4 2 6	
Forge	3 12 6 to 3 15 0	
(3) Lincolnshire—		
Basic	4 0 0 to 4 5 0	
Foundry	4 5 0 to 4 10 0	
Forge	4 2 6 to 4 5 0	
(4) N.W. COAST—		
N. Lancs. and Cum.		
Hematite Mixed Nos.	5 15 0	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 10 0	10 10 0
Best ,,	12 0 0	—
N.E. COAST—		
Crown Bars	12 0 0	—
Tees	10 10 0	—
LANCS.—		
Crown Bars	11 10 0	—
Second Quality Bars	10 5 0	—
Hoops	14 0 0	13 15 0
S. YORKS.—		
Crown Bars	12 0 0	—
Best ,,	13 0 0	—
Hoops	14 0 0	—
MIDLANDS—		
Crown Bars	11 10 0 to 11 15 0	
Marked Bars (Staffs.)	13 10 0	—
Nut and Bolts Bars	10 0 0 to 10 5 0	
Gas Tube Strip	11 0 0 to 11 5 0	
Hoops (Nom.)	14 0 0	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	13 10 0	—
Ship Plates ⅜in. and up	10 0 0	—
Sections	9 10 0	—
Steel Sheets ⅜in. to ½in.	11 5 0	—
Sheets (Gal. Cor. 24 B.G.)	—	16 0 0

STEEL (*continued*)

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	10 0 0	—
Angles	9 10 0	—
Boiler Plates	13 10 0	—
Joists	10 0 0	—
Heavy Rails	9 0 0	—
Fish-plates	14 10 0	—
Channels	14 10 0	—
Hard Billets	8 15 0	—
Soft Billets	7 15 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	9 10 0	—
Light ,,	11 0 0 to 13 0 0	
Billets	9 5 0	—
Ship Plates	10 0 0	—
Boiler ,,	13 10 0	—
MANCHESTER—		
Bars (Round)	9 10 0 to 11 10 0	
,, (others)	10 10 0 to 11 10 0	
Hoops (Best)	15 5 0	15 0 0
,, (Soft Steel)	12 5 0	12 0 0
Plates	9 10 0 to 11 0 0	
,, (Lancs. Boiler)	15 10 0	—
SHEFFIELD—		
Siemens Acid Billets	10 0 0	—
Bessemer Billets	12 10 0	—
Hard Basic	8 15 0	—
Soft ,,	7 15 0	—
Hoops	12 5 0	—
Soft Wire Rods	11 0 0	—
MIDLANDS—		
Small Rolled Bars	9 5 0 to 9 10 0	
Bessemer Billets	7 10 0 to 7 12 6	
Hoops	11 10 0 to 12 0 0	
Gas Tube Strip	10 5 0 to 10 10 0	
Sheets (24 W.G.)	12 10 0	—
Galv. Sheets (f.o.b. L'pool)	16 0 0	—
Angles	9 10 0	—
Joists	10 0 0	—
Tees	10 10 0	—
Bridge and Tank Plates	10 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	19/6 to 20/-
Block Tin (cash)	153 17 6
,, (three months)	154 15 0
Copper (cash)	62 10 0
,, (three months)	62 17 6
Spanish Lead (cash)	24 0 0
,, (three months)	23 7 6
Spelter (cash)	28 13 0
,, (three months)	27 16 3
MANCHESTER—	
Copper, Best Selected Ingots	68 10 0
,, Electrolytic	70 10 0
,, Strong Sheets	94 0 0
,, Loco Tubes	0 1 1½
Brass Loco Tubes	0 0 11½
,, Condenser	0 1 2½
Lead, English	25 15 0
,, Foreign	24 5 0

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit
Tungsten Metal Powder	1/8 per lb.	
Ferro Tungsten	1/5 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£27	10/-
,, 6 p.c. to 8 p.c. ,,	£25 10 0	9/-
,, 8 p.c. to 10 p.c. ,,	£24 10 0	8/-
,, Specially Refined ...		
Max. 2 p.c. carbon	£65	26/-
,, 1 p.c. ,,	£80	30/-
,, 0·75 p.c. carbon	£85	37/-
,, carbon free	1/1 per lb.	
Metallic Chromium	5/3 per lb.	
Ferro Manganese (per ton)	£15 for home.	
,, Silicon, 45 p.c. to 50 p.c.	£13 0 0 scale unit	5/- per
,, ,, 75 p.c.	24 10 0 scale unit	6/- per
,, Vanadium	18/- per lb.	
,, Molybdenum	6/6 per lb.	
,, Titanium (carbon free)	1/3 per lb.	
Nickel (per ton)	£180	
Cobalt	11/- per lb.	
Aluminium (per ton)	£110 to £120 (British Official.)	

FUELS.

	Export.
SCOTLAND.	
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	17/6
,, ,, Ell	17/6
,, ,, Splint	18/6 to 21/6
,, ,, Trebles	20/-
,, ,, Doubles	19/-
,, ,, Singles	18/3
AYRSHIRE—	
(f.o.b. Ports)—Steam	17/6
,, ,, Splint	19/-
,, ,, Trebles	20/-
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	17/6 to 21/-
Screened Navigation	26/-
Trebles	20/-
Doubles	19/3
Singles	18/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	18/9
Secondary Steam	18/-
Trebles	20/6
Doubles	19/3
Singles	18/6
ENGLAND.	
(8) N.W. COAST—	
Steams	33/-
Household	40/- to 61/-
Coke	34/-
NORTHUMBERLAND—	
Best Steams	22/6 to 24/-
Second Steams	20/6 to 21/6
Steam Smalls	13/- to 15/-
Unscreened	20/6
Household	25/- to 28/-
DURHAM—	
Best Gas	21/6 to 22/-
Second	18/6 to 20/6
Household	25/- to 28/-
Foundry Coke	32/6 to 35/-

SHEFFIELD—	INLAND.
S. Yorks. Best Steam Hards	22/- to 23/-
Derbyshire Hards	20/- to 21/-
Seconds	18/- to 20/-
Cobbles	17/- to 19/-
Nuts	16/- to 18/-
Washed Smalls	10/- to 11/-
Best Hard Slacks	12/- to 13/-
Seconds ,,	9/- to 10/6
Soft Nutty ,,	7/6 to 8/6
Pea ,,	7/- to 8/-
Small ,,	2/- to 4/6
House, Branch	36/- to 37/6
,, Best Silkstone	33/- to 34/-
Blast Furnace Coke (Inland and Export)	19/- to 21/-

CARDIFF— (9) SOUTH WALES.	
Steam Coals:	
Best Smokeless Large	25/- to 25/3
Second ,, ,,	24/6 to 24,9
Best Dry Large	25/- to 25/6
Ordinary Dry Large	23/- to 24/-
Best Black Vein Large	24/- to 24/6
Western Valley ,,	24/- to 24/6
Best Eastern Valley Large	24/- to 24/6
Ordinary ,, ,,	22/6 to 23/6
Best Steam Smalls	18/- to 18/6
Ordinary ,,	15/- to 17/-
Washed Nuts	22/6 to 24/-
No. 3 Rhondda Large	26/6 to 27/6
,, ,, Smalls	19/- to 20/-
No. 2 ,, Large	22/6 to 23/6
,, ,, Through	19/- to 20/-
,, ,, Smalls	14/- to 15/-
Coke (export)	35/- to 37/6
Patent Fuel	24/6 to 27/-
Pitwood (ex ship)	31/- to 31/6
SWANSEA—	
Anthracite Coals:	
Best Large	50/- to 52/6
Seconds	40/- to 42/6
Red Vein	29/- to 30/-
Big Vein	42/6 to 47/6
Machine-made Cobbles	57/6 to 60/-
Nuts	55/- to 57/6
Beans	37/6 to 40/-
Peas	24/- to 26/-
Breaker Duff	8/- to 8/6
Rubbly Culm	15/6 to 16/-
Steam Coals:	
Large	22/- to 24/-
Seconds	20/- to 22/6
Smalls	14/- to 16/-
Cargo Through	18/- to 20/-

(1) Delivered. (2) Net Makers' works. (3) At furnaces. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England (7) Export Prices—F.O.B. Glasgow.

(8) Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

French Engineering Notes.

(*From our Correspondent in Paris.*)

Reparations.

A RATHER startling proposal has been made this week by the Minister of Public Works to ensure the carrying out of the various engineering schemes. He points out that while France is unable to find sufficient money to execute her vast programme of hydraulic, railway, canal, harbour and other undertakings, Germany, which should provide the funds necessary for the work of reparation, is not paying anything at all, and is yet able to spend an almost unlimited amount of money upon public works of a similar kind which are intended to place that country in a far better position than it was before the war for carrying on business abroad. The Minister of Public Works has, therefore, come to the conclusion that the only way of getting satisfaction is to arrange for Germany to execute certain public works in France, including the Rhone, Dordogne and other hydraulic schemes, the installation of the hydro-electric plants, the running of transmission lines, the construction of new railways and canals, the extension and equipment of ports, and, possibly, the construction of the Channel Tunnel. The total cost of the programme is estimated at 18½ milliard francs, or, roughly, £344,000,000 at present rate of exchange. There will be, of course, many objections to the scheme, especially from the manufacturing and other interests, which will certainly not look with favour upon the Germans carrying out work that they had expected would be reserved for themselves, but M. Le Trocquer argues that the country cannot allow objections to stand in the way of a system of reparation which will alone enable France to carry out her programme of industrial development. It is quite clear that if France is to rely upon her own financial resources for the execution of the great schemes to be put in hand, she will far exceed the period of fifteen years which has been fixed for their completion, and meanwhile there will be insufficient work for the home industries, while if the Germans took a hand in the work the schemes would be carried through much more rapidly, to the final advantage of the manufacturing industries, which would, moreover, probably be allowed to supply a proportion of the material and machinery required.

Capsizable Boats.

As I referred recently to the unfortunate experience of some of the cargo boats, known as the "Marie-Louise" type, of which a large number was ordered by the State for the coal traffic between England and France at a time when freights were very high. On their being put into service a few months ago, three of the boats capsized, and so great was the outcry that the remaining boats were not allowed to leave the ports pending an inquiry by a special Commission. The opinion of the Commission was that there appeared to be nothing wrong with the boats, which had been constructed to designs supplied by the State Department, but it recommended that special precautions should be taken in the navigation, for if the boats were judged seaworthy, they nevertheless required particular care in handling. This rather ambiguous report did not satisfy the country, and the matter came up for discussion last week in the Senate, when it was stated, amongst other things, that twenty-three boats cost the State from 1700f. to 1800f. a ton, and that ten were sold to private shipowners at 160f. a ton. Ten others are under construction in the arsenals. Some of the Senators were of the opinion that it would be better to "scrap the lot," and finally a motion was passed instructing the Government to cancel all contracts it had given out for the construction of merchant vessels. The resolution was hastily brought before the Chamber of Deputies, which revoked it on the plea that such a drastic measure would have serious financial consequences, since work was already well advanced on fourteen passenger steamers for the Algerian service and on eighteen cargo boats.

Miners' Wages.

The coalowners and miners are still holding to the positions they have taken up respectively over the question of wages, the men refusing to accept any further reduction, and the owners hesitating to take drastic steps so long as they believe there is a possibility of Government intervention in connection with the eight hours' day. The trouble is alleged to arise over the importation of British coal, which in March last totalled 1,200,000 tons, as compared with an average of 800,000 tons before the war, and as, at the same time, the French consumption has been reduced by 35 per cent., it follows that stocks of French coal are rapidly accumulating. The owners declare that the only way out of the difficulty is to bring down the cost of extraction so that they can compete with the British coal. While before the war the cost in wages of extracting a ton of coal was 7.77f., it rose at the end of 1921 to 41.55f., and as the result of the reduction in wages in January last, it now ranges between 35f. and 40f. The effect of the eight hours' day has been to reduce the output by 26 per cent. The miners are faced with the alternative of accepting lower wages or of working more hours, failing which the owners contemplate closing down the pits. At present, the men work 6½ hours "at face." The Minister of Public Works affirms that an additional working hour would reduce the cost of extraction by 10f. a ton.

Dunkirk.

In the hope of securing some of the traffic from Alsace-Lorraine which formerly passed through Antwerp, and is still largely diverted to that port, the Chamber of Commerce of Dunkirk has long contemplated the carrying out of a programme of port equipment which will enable it to compete successfully with Antwerp. It is proposed to install a large floating crane as well as several powerful cranes for dealing with iron ore and other materials. In addition to the grain elevators already existing, a grain silo is to be built, and every facility will be provided for the export of iron and other materials from the east of France by means of the canals, which are to be extended and improved, and for the importation of grain in transit for eastern Europe. At present nearly all the grain traffic passes through Antwerp. The idea is to provide Dunkirk with the most up-to-date equipment for this traffic.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

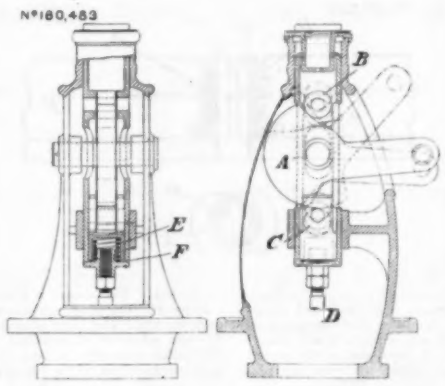
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM ENGINES.

180,483. March 24th, 1921.—VALVE GEARING, R. S. Brailsford and Cole, Marchent and Morley, Limited, Bradford.

THE mushroom valve of an engine is opened and closed by the cam A acting on the rollers B and C mounted on the valve spindle D. In order to compensate for inaccuracies in the con-

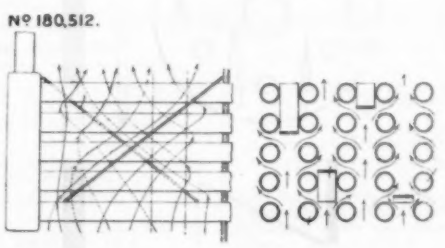


tours of the cam faces a spring E is arranged in the carrier for the roller C, but the clearance at F is only such that in the event of dirt becoming lodged on the valve face or seating the roller carrier closes up this clearance and forces the valve home positively.—*June 1st*, 1922.

STEAM GENERATORS.

180,512. April 13th, 1921.—BAFFLES IN WATER-TUBE BOILERS, Clayton and Shuttleworth, Limited, Lincoln; P. W. Robson, Dunelm House, Church-lane, Lincoln; and R. McGregor, 158, Balfour-road, Ilford.

The inventors propose to check the too free flow of the hot gases between the tubes of water-tube boilers by means of narrow

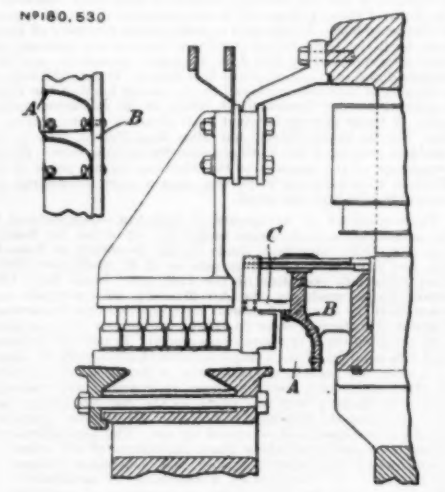


baffles arranged diagonally between the tubes as shown in the illustration. The arrows show the paths of the gases.—*June 1st*, 1922.

DYNAMOS AND MOTORS.

180,530. April 25th, 1921.—IMPROVEMENTS RELATING TO DYNAMO-ELECTRIC MACHINES, Gustof Adolf Juhlin, of Therold Croft, Broad-road, Sale, Chester, and Metropolitan-Vickers, Limited, of 4, Central-buildings, Westminster.

According to this invention a radial fan is mounted between the commutator and armature and a baffle plate is arranged at the outer periphery of the fan and deflects the radial blast of air in a direction along the surface of the commutator parallel with

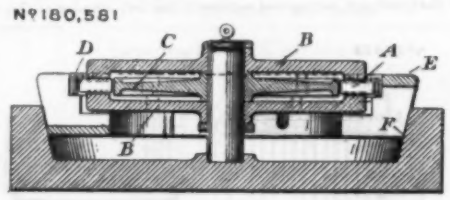


the axis. The blades of the fan are shown at A and they are mounted within a bell-shaped ring B. The inner curved surface of this ring constitutes the deflecting baffle, which deflects the radial blast of air produced by the blades A along the surface of the commutator. Outside the deflecting baffle and between the fan and the commutator a cylindrical baffle C may be provided.—*June 1st*, 1922.

TURBINE MACHINERY.

180,581. June 29th, 1921.—BLADE DISCS, *The British Thomson-Houston Company, Limited*, 83, *Cannon-street, London, E.C.*4.

For the purposes of constructing the blade discs or bucket wheels of impulse turbines the inventors employ short pieces of blading which have projections on their ends that are hardened. These blades, marked A, are assembled between two discs B B, between which the wheel C is housed. A heated ring D is slipped

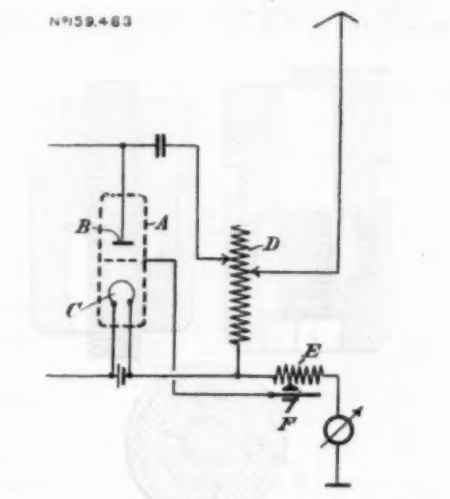


over the ends of the blading and the collapsible ring E is forced down along the sloping face F so that it compresses the ring D and forces the projections on the blades into it. The ring D contracts on cooling and grips the blading firmly. If necessary the whole unit is subsequently brazed up solid.—*June 1st*, 1922.

WIRELESS TELEGRAPHY.

159,463. February 21st, 1921.—IMPROVEMENTS IN THERMIONIC VALVE TRANSMITTERS, Gesellschaft für Drahtlose Telegraphie m.B.H., of 9, Tempelhofer ufer Berlin, Germany.

The potential of the grid of the valve is derived solely from a coil which is situated in the aerial between the anode coil and earth and through which only the aerial current flows, so that the field of the anode coil has no immediate effect upon the grid

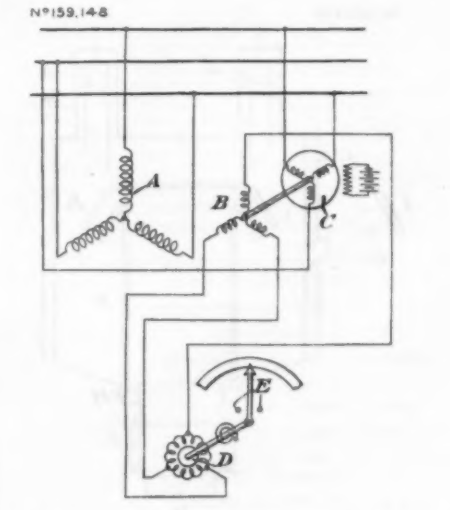


potential. In the drawing A is the valve, B, the anode, C the cathode, D the anode coil, and E the grid coil. With this arrangement unstable working is avoided and oscillations can be generated which are not distorted. Moreover, the energy in the aerial can be varied within wide limits by the regulator F.—*May 22nd*, 1922.

TESTING AND MEASURING INSTRUMENTS.

159,148. February 14th, 1921.—IMPROVEMENTS RELATING TO ELECTRICAL MEASURING, INDICATING OR RELAY APPARATUS FOR POLYPHASE CIRCUITS, *The Metropolitan-Vickers Electrical Company, Limited, of* 4, *Central-buildings, Westminster.*

With the aid of the instrument described in this specification various factors, such as positive and negative phase sequence, components of volt amperes, watts, and also the unbalanced



factor of a system, may be calculated, the determination of these quantities being deemed to be of value in the computation of energy charges, and may be computated from the indications of the instrument. The stator windings A of an induction motor are connected to the three-phase mains and the rotor windings B are driven synchronously by a synchronous motor C. The wind-

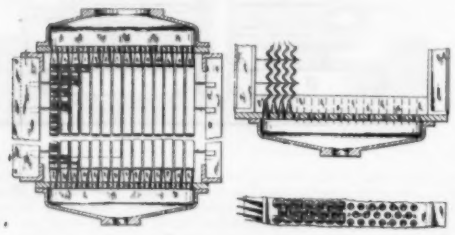
ings B are connected to a motor D having relatively small-torque, which constitutes an indicating instrument and which may be provided with contact members E for connecting to a relay circuit. The method of using the instrument is described.—*May 15th*, 1922.

AERONAUTICS.

180,423. February 21st, 1921.—STEAM AERO-ENGINES, D. McNab Ramsay, 156, Stanmore-road, Mount Florida, Glasgow.

This specification covers an air-cooled condenser for working in conjunction with a steam turbine for propelling aeroplanes. The active surface of the condenser is provided by copper tubes flattened and corrugated as shown, but left circular at the ends

N°180,423



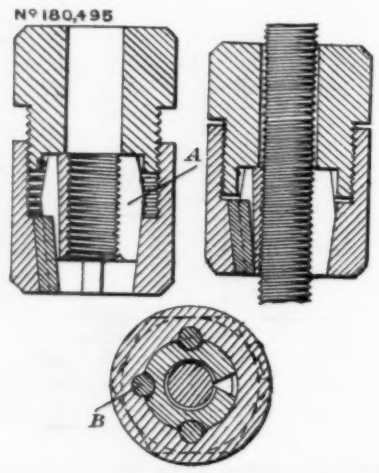
so that they may be expanded into the tube plates of the headers. The bunches of tubes are so placed on the aeroplane that their flat sides lie at a slight angle to the direction of the draught flowing through them, with the object of preventing the formation of pockets of dead air.—*May 22nd*, 1922.

MACHINE TOOLS AND SHOP APPLIANCES.

180,495. April 2nd, 1921.—STUD BOXES, W. Whelan, 2, Moor View, Mutley, Plymouth.

In this stud box the stud is gripped by the split conical threaded sleeve A, which is prevented from turning in the body

N° 180,495



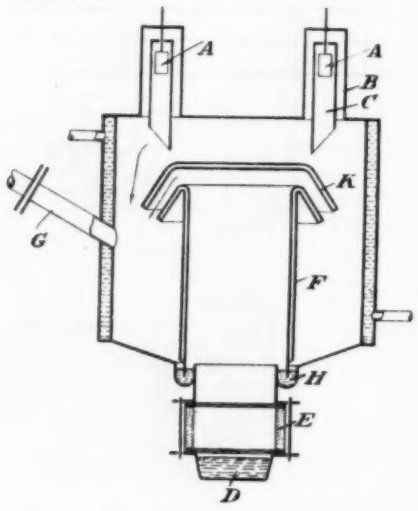
by the keys B. The sleeve A is squeezed down on to the stud by means of the upper part of the box, which is screwed into the lower half with a left-hand thread.—*June 1st*, 1922.

MISCELLANEOUS.

163,325. May 17th, 1921.—IMPROVEMENTS IN OR RELATING TO VACUUM RECTIFIERS, Siemens-Schuckertwerke Gesellschaft mit Beschrankter Haftung, of Siemensstadt.

The object of this invention is to enable vacuum rectifiers to be built for several thousand volts. The vessel contains a number of anodes A which are situated in side "arms" B and protective tubes C. The cathode D is insulated from the vessel by means of

N°163,325

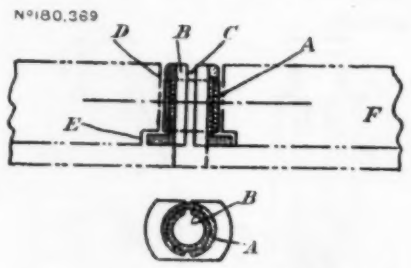


a jointed insulating ring E. The mercury vapour generated by the electric arc is first used for freeing the upper part of the vessel from occluded gases. The vapour is shut off from the chamber by means of the double-walled screen F. The passage of the vapour within the screen is indicated by the lower arrow and it produces a suction effect in the upper part of the vessel, as indicated by the upper arrow. In the upper part of the vessel where the anodes are placed a high vacuum is formed, whereas in the lower part of the vessel the vacuum is less pronounced, and the gases are pumped out of this part of the chamber through the pipe G, and the mercury that condenses on the walls of the vessel runs back to the cathode through a mercury overflow H. The path of the electric arc from the anodes to the cathode D is broken several times by the bell-shaped arrangement K and the cylindrical screen F, with the result that a rather excessive voltage drop occurs in the rectifier; but this is not a great disadvantage in the case of rectifiers working at high pressures. It will be gathered that the main chamber is provided with a water jacket.—*June 1st*, 1922.

180,369. October 11th, 1921.—IMPROVEMENTS IN PLUG AND SOCKET ELECTRIC COUPLINGS, William Joseph Polyblank, of the Istrument Design Establishment, Royal Air Force, Biggin Hill, Kent.

This invention relates to improvements in sockets for plug and socket electric couplings or connections, and more particularly couplings having soft metal conducting pins or plugs of solid, hollow or split formation. A spring collar A surrounds a flanged or shouldered socket B which is slotted as at C. The slot extends

N°180,369



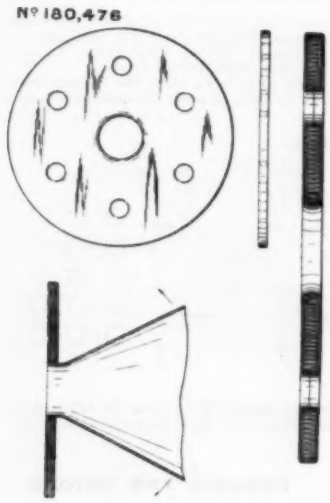
from the top to the bottom of the socket. The socket is placed loosely in a hole D and recess E in a base F. The plug—not shown—is inserted at the upper end of the socket. The form of socket shown is particularly adapted for use where it is necessary to limit the depth of the socket. The socket may also be used with advantage with multiple plugs, as the sockets can move laterally.—*June 1st*, 1922.

TRANSMISSION OF POWER.

180,476. March 22nd, 1921.—FLEXIBLE COUPLINGS, R. and J. Dick, Limited, and D. Todd, Greenhead, Glasgow.

The fibrous discs of flexible couplings are made, according to this invention, of flat pieces of balata belting, cut out to shape and wrapped in a material knitted with cotton or flax. The

N° 180,476



wrapping is made in the form of a tube and is put on the disc in the manner shown in the lower illustration. The whole disc is then heated and pressed to make the several plies adhere to one another.—*June 1st*, 1922.

THE INSTITUTION OF ELECTRICAL ENGINEERS.—The conversazione of the Institution of Electrical Engineers was held at the Natural History Museum, South Kensington, on the evening of Thursday last. A large and representative company of guests from both the London and territorial centres was present, and they were received by Mr. J. S. Highfield, president, and Mrs. Highfield and the Council of the Institution. During the evening selections of music were played by the string band of the Royal Engineers in the Central Hall, while in an adjoining gallery many of those present listened with pleasure to the singing of Miss Phyllis Carey-Foster and Miss May Peters, and to the excellent playing of the Philharmonic String Quartette. By the permission of the trustees of the Museum certain parts of the Museum were open for inspection, and a most interesting and enjoyable evening was spent.

INVESTIGATION OF ACCIDENTS IN THE AIR.—Regulations for the investigation of accidents under Sec. 12 of the Air Navigation Act, 1920, have been made by the Secretary of State for Air, and have been placed on sale by H.M. Stationery Office. They come into operation on the 12th inst. Since May, 1919, arrangements made by the Air Ministry with aircraft companies and the owners of aircraft have enabled this Department without statutory powers to conduct inquiries into accidents with the goodwill of the parties concerned. It was felt, however, that the conduct of such inquiries should ultimately be placed on a statutory basis in the same way as inquiries into accidents in other industries, notably those of shipping and railways, and accordingly power was taken in the Air Navigation Act, 1920, enabling the Secretary of State for Air to issue regulations for the investigation of accidents by air. The regulations now issued are based upon three years' experience of the voluntary system which has hitherto existed, and their main features are as follows:—(1) Compulsory notification of accidents; (2) statutory powers for preliminary investigation of accidents by an Inspector of Accidents appointed by the Secretary of State; (3) statutory powers to order, if deemed necessary, a formal investigation by a person specially appointed by the Secretary of State; and (4) statutory authority for the publication of the whole or part of the report of an investigation.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TUESDAY TO TUESDAY, JULY 4TH TO 11TH.

THE SOCIETY OF CHEMICAL INDUSTRY.—Glasgow. Annual general meeting. For programme see page 710.

THURSDAY, FRIDAY AND SATURDAY, JULY 6TH, 7TH AND 8TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Scottish District meeting at Perth. For programme see page 733.

TUESDAY TO FRIDAY, JULY 18TH TO 21ST.

HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.—Ninety-first annual Show at Dumfries.

WEDNESDAY TO FRIDAY, SEPTEMBER 20TH TO 22ND.

THE INSTITUTE OF METALS.—Swansea. Annual autumn meeting.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE business offices and manufactory of the British Clip Company have been transferred to 146, Blackfriars-road, S.E. 1, to which it is requested that all communications should be addressed in future.

WE are asked to state that Messrs. Truslove and Co., St. Peter's Engineering Works, Colchester, have just appointed as their London manager Mr. James Sambidge, M.I.M.E., and that their London office will henceforth be 17, Victoria-street, Westminster, S.W. 1. Telephone: Victoria 530 and 1061. Telegrams: "Prefix, London."

LAUNCHES AND TRIAL TRIPS.

SAMUELSON, cutter suction hopper dredger; built by Wm. Simons and Co., Limited; to the order of the Government of India. Engines, triple-expansion. Launch, June 23rd.

AMSTERDAM, steel screw tanker; built by Sir W. G. Armstrong, Whitworth and Co., Limited; to the order of the American Petroleum Company, Rotterdam; dimensions, 455ft., 57ft. 6in., 33ft. 11in.; to carry 10,450 tons deadweight. Engines, triple-expansion, pressure 180 lb.; constructed by the builders; launch, June 28th.

CHARGING MACHINES FOR CUPOLAS.—In describing, in our issue of June 30th, the cupola-charging machinery exhibited at the recent Foundry Exhibition by Thwaites Bros., Limited, of Bradford, which embody an ingenious patented two-speed mechanism, we accidentally gave the capacities of the three sizes of power-driven machine as being ¾ cwt., 7 cwt., and 16 cwt. They should really have read ¾ cubic foot, 7 cubic feet, and 16 cubic feet, which would correspond to approximately 5½ cwt., 13½ cwt., and 37 cwt. of broken pig iron.

ROYAL INSTITUTION.—A general meeting of the members of the Royal Institution was held on Monday afternoon, July 3rd, Sir James Crichton-Browne, treasurer and vice-president, in the chair. Viscountess D'Arcy, Miss E. Fairfax, Sir Thomas Fisher, K.B.E., Mrs. Grove-Hills, Mr. J. Hetherington, Mr. A. J. Lambert, Mr. W. F. Roch, Captain Riall Sankey, C.B., Lieut.-Colonel J. A. Stirling, D.S.O., M.C., and Mr. C. Tierney were elected members. The death of the Prince of Monaco, an honorary member of the Institution, was announced and a resolution of condolence was passed.

SIXTY YEARS' SERVICE.—An interesting ceremony was performed on Monday, the 3rd inst., when the directors of Alldays and Onions, Limited, presented an inscribed gold watch to Mr. Albert Williams, in recognition of his sixty years' uninterrupted service with the company. The function took place in the large concert hall at the firm's Great Western Works, Small Heath, Birmingham, which was crowded by an assembly numbering several hundreds, which included the heads of departments and representatives of all grades. Mr. H. Marks, chairman of the company, presided. The presentation was made by Mr. A. T. Cocking, one of the directors, who outlined the career of the recipient. He told how Albert Williams had entered the concern at the age of eleven, in June, 1862, working under his father at 2s. 6d. a week. At that time the firm was J. C. Onions and Co., the establishment of which was in Bradford-street, the amalgamation with the late Mr. William Allday coming about later. During the whole of Albert Williams' record he had been absent from work only four days, by reason of illness, and had never been late. He always walked to business, and did so still—a good mile and a-half. Williams was, it was explained, continuing the paternal tradition, for his father—like the son, a bellows maker—was with J. C. Onions and Co. for a period of between sixty-three and sixty-four years, when he retired.

CANADIAN TIMBERS.—The Imperial Institute Advisory Committee on Timbers is conducting an inquiry into the possibility of extending the use in Great Britain of the timbers produced in the various countries of the Overseas Empire. A number of reports have been furnished to the Governments concerned, some of which have been published from time to time in the *Bulletin* of the Imperial Institute. The current number contains reports on certain timbers from British Columbia and the Eastern Provinces of Canada. The attention of H.M. Office of Works was called by the Committee to the value of British Columbia Douglas fir, spruce and hemlock for constructional purposes, and it is reported that as a result of special strength tests and joinery trials, these woods are now included in their official specifications for Government buildings as alternatives to European woods. The Eastern Canadian timbers dealt with comprise soft woods, such as spruce, red pine and yellow or white pine, while the hard woods include white birch, rock maple, beech and white elm. The Committee considers that the technical qualities of Eastern Canadian timbers are such as to warrant a far larger use of the woods in this country than obtains at present. It is of opinion that spruce and red pine, in particular, should find a good market, since they form admirable substitutes for Baltic white and red deal respectively. Yellow or white pine is already well known, but should also be more extensively used. H.M. Office of Works will permit the use of these Eastern Canadian timbers by contractors for Government buildings if the woods conform to the official standards of quality. It is also understood that the three soft woods mentioned have been accepted by the War Office as alternatives to European soft woods.